UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF OHIO
WESTERN DIVISION

OHIO A. PHILIP RANDOLPH INSTITUTE, et al.,	Case No. 1:18-cv-357
Plaintiffs,	***Day 4 of Bench Trial***
- v -	Thursday, March 7, 2019
LARRY HOUSEHOLDER, et al.,	9:02 AM
Defendants.	Cincinnati, Ohio

- - -

TRANSCRIPT OF PROCEEDINGS
BEFORE THE HONORABLE TIMOTHY S. BLACK, THE HONORABLE KAREN NELSON MOORE AND THE HONORABLE MICHAEL H. WATSON, JUDGES

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Proceedings recorded by stenotype; transcript produced by computer-aided transcription.

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P R O C E E D I N G S

(In open court at 9:01 AM.)

JUDGE BLACK: Good morning. Please be seated.

We are here in the open courtroom back on the record in trial to the bench in *APRI versus Householder, et al.* Plaintiffs' counsel is here. Defense counsel is here. Intervenors' counsel is here.

Is there anything we ought to address before we proceed to the calling of the next witness of the plaintiffs?

MR. FRAM: Your Honor, Robert Fram. I've got the honor of reporting on the time this morning.

JUDGE BLACK: Yes, sir.

MR. FRAM: Okay. So yesterday, we had for the plaintiffs 123 minutes and for defendants and intervenors 229 minutes, for a total for the plaintiffs so far, 559 minutes, and defendants and intervenors of 504 minutes.

JUDGE BLACK: Magnificent.

The other side agrees?

MR. STRACH: That's correct.

JUDGE BLACK: A credit to you.

JUDGE WATSON: 504?

MR. STRACH: Yes, sir.

JUDGE BLACK: Very well. Are we ready to proceed to taking additional testimony, from the plaintiffs perspective?

MS. LEVENSON: Yes, Your Honor.

JUDGE BLACK: The others as well?

MR. McKNIGHT: Yes, Your Honor.

MR. LEWIS: Yes, Your Honor.

JUDGE BLACK: Very well.

Who does the plaintiff call at this time?

MS. LEVENSON: Your Honor, plaintiffs call Dr. David Niven.

JUDGE BLACK: If Dr. Niven would be willing to approach.

If you'd be willing to pause and raise your right hand for the oath to tell the truth. Do you solemnly swear or affirm that the testimony you give today is the truth subject to the penalty of perjury?

THE WITNESS: I do.

JUDGE BLACK: Very well. Good morning.

THE WITNESS: Good morning.

JUDGE BLACK: I disclose to all witnesses that the seat tips back. We're going to need you here, the fancy federal microphone.

And, counsel, when you're prepared, you may begin.

MS. LEVENSON: Thank you, Judge. Freda Levenson, again, on behalf of the plaintiffs.

J. DAVID NIVEN

a witness herein, having been first sworn, testified as follows:

DIRECT EXAMINATION

BY MS. LEVENSON:
Q. Good morning, Dr. Niven.
A. Good morning.
Q. Dr. Niven, can you please state your full name and spell it for the record?
A. J. David Niven, D-a-v-i-d N-i-v-e-n.
Q. Thank you. And could you kindly share with us who you are.
A. I am a political science professor at the University of Cincinnati.
Q. Have you served as an expert witness before?
A. I have not.
Q. What academic degrees do you hold?
A. I have a bachelor's degree in political science from Rutgers University and a Ph.D. in political science from Ohio State University.
Q. What courses do you teach at the University of Cincinnati?
A. I teach American Congress. I teach the government and politics of Ohio. I teach political parties. I teach American political thought, and a handful of other American politics courses.
Q. Are you tenured?
A. Yes.
Q. What graduate courses do you teach at the university?
A. I have taught a seminar in American government and a seminar in political parties.

Q. Can you describe the specific areas of your scholarly interest?
A. My research really runs the range of questions of representation, matters of public opinion, voting preferences, all the way through the policy formation and output of officeholders. So my focus really is -- the range from where I -- a person's preferences might come from, how they're expressed, to, ultimately, the output that they get from their officeholders.
Q. Where has your work in these areas been published?
A. I have published in political science journals and other social science journals including, top journals, *American Politics Research*, *Polity*, *Political Research Quarterly*, *Social Science Quarterly*, *The Journal of Politics*.
Q. Approximately how many peer-reviewed articles and chapters have you published?
A. Approximately three dozen.
Q. Approximately how many peer-reviewed scholarly books have you published?
A. Five.
Q. How many journals have requested you to serve as peer reviewer for scholarly research in your area?
A. Approximately two dozen.
Q. How many papers have you published relative to the United States Congress?

A. About a dozen are specific to matters of Congress.
Q. What organizations have funded your research?
A. My research has been funded by the American Political Science Association, by the John F. Kennedy Library, by the Shorenstein Center at Harvard University.
Q. So in your scholarly work what approach do you take to studying questions about legislative districting?
A. I have used public opinion data. I have used election data. I have used census data and I have taken sort of a deeper, you know, geographic look, for example, in a study on the politics of south Florida.
Q. Has your research using that approach been published in any scholarly literature?
A. Yes. This is the work that's been published across political science journals.
Q. What is your past employment?
A. Before I began teaching at the University of Cincinnati, I served as a speech writer for the president of Ohio State University. I served as a speech writer for the governor of Ohio. Previous to that I was employed in academic fields, including as a tenured professor at Florida Atlantic University and as a visiting fellow at Ohio State University's College of Law in their policy law and social science division.
Q. And which governor was that?
A. That was Governor Ted Strickland.

MS. LEVENSON: May I approach the witness, Your Honor, to hand him a copy of his exhibit binder?

JUDGE BLACK: Yes. Thank you.

MS. LEVENSON: Thank you. Have the exhibit binders been distributed at this time?

A. They've already --

MS. LEVENSON: You've got one, okay.

Tess, you're ahead of me.

Q. Doctor, could you please look at the document that's behind tab 1, your CV?

A. Yes.

Q. And, for the record, it's marked for identification as Plaintiffs' 525 and also as Intervenors' 33.

Dr. Niven, this is your CV; is that correct?

A. Yes.

Q. Has your CV been updated since this version?

A. There would be multiple published papers that occurred after I submitted the CV, and a handful of research conference papers that would need to be added.

Q. Approximately when did you submit this CV?

A. This is from October of 2018.

MS. LEVENSON: Your Honors, we have given the updated version to the defendants and to the intervenors. At this time I'd move to place the CV into evidence as Plaintiffs' Exhibit 525.

JUDGE BLACK: Any objection?
MR. McKNIGHT: No objection, Your Honor.
JUDGE BLACK: It's admitted.
(Plaintiffs' Exhibit 525 was admitted.)
MS. LEVENSON: Your Honors, plaintiffs tender Dr. Niven as an expert witness, expert in the field of political science, and I so move.
MR. McKNIGHT: Your Honor, we ask --
JUDGE BLACK: Yes, go ahead.
MR. McKNIGHT: We don't object, subject to the motion that we filed earlier.
JUDGE BLACK: Very well. You're aware that he's a professor at the University of Cincinnati?
MR. McKNIGHT: I am, Your Honor.
JUDGE BLACK: That he has a degree from The Ohio State University?
MR. McKNIGHT: I am, Your Honor.
JUDGE BLACK: And that his funding, in part, comes from Harvard?
MR. McKNIGHT: I am, Your Honor.
JUDGE BLACK: Very well.
MS. LEVENSON: Thank you, Judge.
JUDGE BLACK: He's admitted conditionally as an expert. Congratulations.
THE WITNESS: Thank you.

MS. LEVENSON: Thank you.

Q. Dr. Niven, did you furnish a report of your data, methods, findings and conclusions relating to your work in this case?

A. I did.

Q. And did you subsequently furnish a second report, a rebuttal report, with further explanations of your data, methods, findings and conclusions?

A. I did.

MS. LEVENSON: Among the parties, Your Honors, it's been agreed that since Dr. Niven is testifying live here today, his expert report and rebuttal report may be admitted into evidence. His expert report is marked P524 and I32. It's in tab 2 of everyone's exhibit binder. And Dr. Niven's rebuttal report is marked P526 and I34, and it's located at tab 3. I move to enter these exhibits into evidence.

MR. McKNIGHT: No objection.

JUDGE BLACK: And subject to the defendants' *Daubert* motion?

MR. McKNIGHT: That's correct.

JUDGE BLACK: It's admitted. Both are admitted conditionally. Thank you.

(Plaintiffs' Exhibits 524 and 526 were conditionally admitted.)

JUDGE BLACK: Very well.

Q. Dr. Niven, can you tell the Court what the plaintiffs asked

you to study in this case?
A. I was asked to examine Ohio's congressional districts to consider questions of the degree to which the districts reflect the communities of interest, the political preferences of local residents to consider the degree to which the districts were, you know, congruent or incongruent with local communities and local governments and the like.
Q. I'm going to ask you about the design of your study and how you carried it out and your specific findings in a moment, but, first, can you just share an overview of your conclusions.
A. In sum, what I found was a relentless commitment to splitting, splitting political subdivisions, splitting communities of interest, splitting neighborhoods, in some cases even splitting neighbors from neighbors.
What I found is that that splitting had a distinct partisan tinge such that Democratic census tracts, or, in effect, Democrat neighborhoods, were more likely to be split than Republicans.
What I found was that relationship was statistically significant and replicable. You could see it by looking in different ways and come to the same conclusion. And then, therefore, ultimately, that Democrats were targeted for splitting between multiple congressional districts at a cost to their representation by members of Congress.
Q. Did you perform any analysis as to whether this pattern

could be the product of chance?
A. I did subject this question to a variety of tests of statistical significance, and the relationship consistently came back statistically significant.
Q. Did you look at all as to whether these patterns created any technical advantages for Republicans as opposed to Democrats?
A. Well, the political science literature is very clear that the more you subject a neighborhood to political splitting, you know, splitting of assignment to a district, it has a demobilizing effect. It has an effect both on individuals who can be confused over just who represents them and who they're allowed to vote for, and it's also demobilizing organizationally. It's harder for parties and other entities to go into a neighborhood and activate voters when those voters live in separate districts and, therefore, are responding to separate candidates.

Even something as mundane as a yard sign, political science research has found that yard signs for political candidates actually affect people and increase voter turnout but that can only work when the yards in your neighborhood get to put up signs for the same set of candidates; otherwise, it's just productive of confusion.
Q. Briefly, what are the types of study that you perform to reach the conclusions that you report?

A. Well, I took two main approaches. One was to look at statewide patterns, for example, looking at the assignment of census tracts to congressional districts across the entirety of the state. I also looked statewide at a matter of where congressional district offices were located and how that corresponded to citizens' residences.

But then I also took a deeper look at particular districts and the way they were created and who was included in them and who was excluded from them across several, you know, critical areas in the state where the map especially diverged from the previous one.

Q. Dr. Niven, you mentioned these two types of studies that you performed, basically the analysis of the census tracts and then the second math-driven more qualitative type of research.

With regard to the first, your analysis of census tracts, can you describe, still without getting into the weeds, what you were looking at?

A. Well, what I was looking at was the degree to which census tracts were kept whole, which is to say assigned entirely to one congressional district or the degree to which they were split among two or, in some cases, more than two congressional districts.

Q. So why would you look at them in that way?

A. Well, they're an indicator of whether mapmakers sought to split -- sought to impose splits and division on voters.

They're an indicator of the degree to which you could expect your neighborhood to be kept whole and assigned to one congressional district.

And there's something that, very usefully, census tracts are designed to be stable and reliable and meaningful indicators so you can study patterns over time, and, indeed, census tracts have been employed by hundreds of researchers studying questions of all manner of social science for this very reason.

Q. For your analysis of census tracts, what data sources did you rely on?

A. I relied, in principle, on the OCURD data, the Ohio Common and Unified Redistricting Data that was created by researchers at Cleveland State for the state's legislative service commission ultimately for the mapmakers, and then I supplemented that with additional census data.

Q. How did you use the OCURD data?

A. Well, the OCURD data, principally, is population data and political data, so it has an array of election outcomes and it has an array of population indicators, the size of population, the -- for example, the census, census tract and census block designations. So I employed the data to basically construct a political index of how Democratic or Republican any individual census tract might be.

Q. Was the election data and the census tract data all

available to the Republican map drawers in 2011?
A. Yes. This is the data that was officially created for the state, for the state mapmakers, and it was entirely built on elections that had just preceded the drawing of the map. So these are 2008 and 2010 elections.
Q. So you mentioned "indexes" rather than "index." Did it matter which index you used when you performed your study?
A. Ultimately, the conclusions stayed the same, and the direction was absolutely consistent regardless of which election I focused on at any given moment.
Q. As to your data, I have a document marked for identification as Plaintiffs' 472.

MS. LEVENSON: For those on paper, it's under tab 4.

Q. Dr. Niven, can you identify what these couple of sheets are?
A. Yes. This is a spreadsheet that represents the data that I was working with.
Q. Is this sample representative of the entire set?
A. It appears to be representative, though in -- oh, here it is. Okay.

Yes, this does appear to be representative.

MS. LEVENSON: Well, I represent that this is just the first page of the exhibit. The exhibit itself is a heftier compilation of pages that resemble this one, and defendants and intervenors have it in full, and a full copy has been filed

with the Court. At this time I move to enter the data set into evidence as Exhibit Plaintiff 472.

JUDGE BLACK: Any objection, other than the continuing objection?

MR. McKNIGHT: No, Your Honor.

JUDGE BLACK: It's admitted conditionally.

MS. LEVENSON: Thank you.

(Plaintiffs' Exhibit 472 was conditionally admitted.)

Q. Dr. Niven, back to your methods. What scholarship did you rely on?

A. Well, one of the fundamental areas that I was guided by is the research of Richard Fenno, who is something of the dean of research on the relationship between members of Congress and their constituents.

Q. So who is Richard Fenno, more specifically?

A. Richard Fenno is a political science professor at the University of Rochester who, for more than 50 years, has been studying the relationship between members of Congress and their constituents. He's really something of the father of a subfield in political science that looks at questions of members of Congress behavior, not strictly in the Capitol building casting votes, but in their districts interacting with voters and, you know, what their -- what their perspectives are on the folks that they represent.

Q. To what degree is his work accepted among political

scientists?
A. It is highly cited. It is considered, as I said, something of a founding document in congressional research.
Q. How does partisan gerrymandering affect the nature of the relationships between members of Congress and their constituents?
A. Well, in the Fenno research and in the political science literature overall, there's a couple of fundamental effects here. One is that when a member is in the district, Fenno's research shows very closely that they don't necessarily conceptualize the entirety of the district. They don't necessarily think of every single voter as 1/700,000 of the district. Rather, there are areas that are first and foremost in their mind, groups of voters that are first and foremost in their mind.

So what a gerrymander can effectively achieve is creating a favored group of voters. What -- Fenno's research, he would consider to be the -- the concentric circle of voters that the member attends to, thinks about, spends time with, listens to, and then peripheral voters who don't have access to their member, who aren't going to be heard, for whom the member is not going to show up at their -- you know, at their local Rotary Club meeting or the like.

The second effect is that it can create isolation geographically, not just politically but geographically, by

combining areas that have little in common, by combining areas that are literally disparate in distance. There can be areas of a district that simply get less attention from a member. And Fenno's research and those who followed on him have made this very, very clear, that representation is not created equally, and that these kinds of -- these kinds of divisions, you know, create, in effect, a favored and a disfavored set of constituents.

Q. Thank you. Let's look now in more detail at your census tracts analysis. What is a census tract?

A. A census tract is a division created by the census for the purposes of research and analysis. It is meant to be fairly stable. It is meant to be a kind of indicator that you can use over time to measure, for example, the health of a -- of a neighborhood. It varies a bit in size both in terms of number of people and geographic size. In a city, it's going to be a much more compact shape. In a small town, it could encompass the entirety of the town. You know, for the purposes of understanding the map, it's -- it's basically an indicator of whether you and those in your neighborhood were kept in one congressional district or split among more than one.

Q. How many census tracts are there in Ohio?

A. Approximately 3,000.

Q. In the congressional map that was in place in the previous decade, the 2001 through 2011, how many Ohio census tracts were

split in two or more parts by the district lines?
A. 209.
Q. In the current map, how many census tracts are split?
A. 332, which is a 59 percent increase.
MS. LEVENSON: Stephen, can --
Q. Oh, were you speaking? I'm sorry.
A. A 59 percent increase, which is to say, you know, a rather massive reorientation toward splitting people from -- from their neighborhoods in congressional districts.
MS. LEVENSON: Stephen, could you kindly display Plaintiffs' 524 at page five, the graph. For those on paper, this is located in your binders at tab 2, page five. This is from Dr. Niven's report.
Q. Doctor, what does this show?
A. This is the comparison of how many census tracts were split under the previous map compared to the current map in Ohio.
Q. As a little bit of a preview of what we'll explore shortly, did this splitting occur evenly across the map?
A. It was concentrated in places, places like Summit County, for example, where the county was split into pieces, and then within the county, census tracts were split into pieces.
Q. So why is this increase of 59 percent meaningful?
A. Well, it's meaningful because it's an indicator of the willingness or, indeed, the desire to strategically split people within their neighborhood. You know, this is -- this is

kind of a health indicator of the map drawing process, and what this is showing is the process got a lot less healthy from the last round to the current round, and there was an increased willingness.

The only reason to split census tracts -- there's no -- there's no purpose to it other than for political advantage, so -- especially when you look at Ohio relative to other states, you see this relationship and you can use it as a guide to the degree to which a political advantage was sought.

Q. Again, as sort of a preview of what we're about to look at, did this impact Republicans and Democrats equally?

A. It did not.

Q. Let's look at that.

MS. LEVENSON: Stephen, Plaintiffs' 526, page two, the table. This is at tab three, which is the rebuttal report, on page two.

Q. Dr. Niven, can you explain how to interpret the voting index numbers in each of the columns on this table?

A. Certainly. Each of the columns is a number between zero and one, and the higher the number, the closer to one, the more the Republicans have been supported there; the lower the number, the closer to zero, the more Democrats have been supported there. So in a really simple sense, in that left column, intact census tracts, essentially 52 percent of the vote in the races in that index went Republican; in the split

census tracts, 49 percent in those same races went Republican.
Q. So what do you conclude from looking, first, at the column that has been highlighted?
A. What that shows is that intact census tracts were more Republican than split census tracts. Or to put it another way, split census tracts were more Democratic than intact census tracts. So there was a partisan difference in the likelihood of a tract being split, and that is a statistically significant difference. It couldn't have occurred by chance alone.
Q. So the numbers .52 and .49 on the surface don't appear to be that far apart from each other. Can you explain the significance of the difference, the magnitude of this?
A. Well, what's really important here is that every way that you look at this data, it comes back showing that Republican areas were more likely to be kept intact and Democratic areas were more likely to be split. So, yes, this is a three percent difference. Three percent, of course in Ohio, is often the difference between winning and losing. But more than just the three percent, it's the consistency of the difference. It keeps coming back, regardless of how you look at the question, with the more Republican area being advantaged to being kept intact and the more Democratic area being disadvantaged and being split.
And so, you know, this is very much along the lines of if you flipped a coin a few times, it wouldn't tell you very much

about whether there was a fair coin. But if you flipped it hundreds and hundreds and hundreds of times and every time in that hundred it came back, you know, something like 51 percent or 52 percent heads, you would say there's a bias to that coin.

Well, there's a bias to these numbers. It comes back with a pro-Republican slant on intact census tracts regardless of how you measure it.

MS. LEVENSON: Stephen, still on this page moving down to the second paragraph under the table. Can you put up the bold face sentence.

Q. So, Dr. Niven, how else did you examine this data?

A. Well, what we were just looking at was the question of comparing intact and split census tracts. So then I flipped the question around and wondered, What happens if you compare Democratic and Republican census tracts? So this is fundamentally trying to answer the same question, but doing it in the opposite direction.

And so what I did was label each census tract Democratic if more -- more than half the votes went Democratic, Republican if more than half the votes went Republican. And what I found was a pronounced difference, such that Democratic census tracts, Democratic areas were 46.8 percent more likely to be split between multiple congressional districts than Republican areas.

Q. So does it matter whether you analyze this question by comparing intact versus split census tracts or by comparing

Democratic versus Republican tracts?
A. It doesn't matter whether you look at the question from the perspective of intact versus split census tracts first, or if you look at the question from Democratic versus Republican census tracts, nor does it matter whether you look at this question by examining data from four elections or from eight elections or from just the presidential election. Every single time, it comes back to the same answer.
And one of the principles in social science regarding the credibility of data is whether it can be replicated. Would you get the same answer if you looked at the question differently? Would you get the same answer if you looked at a different set of data? And this is precisely what replication is, and we're getting the same answer no matter how we ask the question.
Q. Actually, did you receive confirmation from an additional surprising source?
A. It is interesting. The defendants' own expert looked at census tracts and concluded in her work that, indeed, intact census tracts were more Republican and split census tracts were more Democratic as she looked at the data.
And so, again, that is the essence of replication. It didn't matter which election you looked at, it didn't matter which direction you looked at it, and it didn't actually even matter who looked at it. It comes to the same answer. Democrats were more likely to be split between congressional

districts than Republicans.
Q. So why did you use census tracts for this analysis? You began to explain that they're stable over time. What would be other reasons for making this choice?
A. The Census Bureau directly reports on the assignment of census tracts. This is the kind of number that they literally keep track of, and so this is a reliable indicator of the shape of the map and the nature of the map in Ohio and indeed across the country.
As I said, it is a level of analysis that can be done meaningfully over time, so you can make a comparison between this map and what happened to census tracts ten years ago. And it's also a measure that you can use to make comparisons across states, as their census tracts across states.
Q. So why not use census blocks?
A. Census blocks are really tiny, sort of street level in an urban area, literally, a street level indicator. You know, they aren't as, sort of, functional for this kind of analysis. They're -- they're less stable and they are therefore a less reliable indicator of what is going on with the map over time.
Q. So you explain that you found a statistically significant difference in the treatment of areas where Democrats live versus where Republicans live. What does that mean?
A. It basically means that this could not have happened by chance alone. When we talk about statistical significance in

social science, you know, what we're saying is could this have just happened? You know, if you, metaphorically, threw all these census tracts up in the air, could it be that they would land in such a way that the Democrats would always be more likely to be split? And the answer is no. No, it could not have happened that way.

And, indeed, across these measures, the level of statistical significance is vastly beyond social science standards. You can -- you can publish a paper in political science with a statistical significance, essentially, of a one-in-20 chance -- a one-in-20 possibility that chance could explain what you saw.

This is not one in 20. It's not one in a hundred or one in a thousand. It's actually well beyond one in a million or one in a billion that this relationship would be found and that it would be found again and again and again, such that Democrats were more likely to be split than Republicans.

Q. And what does that pattern tell you?

A. What the pattern tells us from statistical significance is that this was done intentionally. It couldn't have happened by chance. It was done -- it was done for a purpose. And, you know, that is -- you know, as I said, in social science, our standards, you know, we would -- we would begin to make that assertion with evidence far less rich than this is.

Q. Did you consider that there could be some other explanation

than a purpose?
A. Well, what statistical significance means is somebody did this for a reason. It doesn't necessarily tell you what that reason is.
But what an analysis of the statewide map would suggest is the reason was partisan advantage. You wouldn't need to do this to make compact districts. You wouldn't need to do this to make contiguous districts. You wouldn't need to do this to make districts of roughly equal population. You wouldn't need to do this in pursuit of any -- of any other redistricting priority. It, therefore, suggests it was done for partisan reasons.
As an example, Iowa has a non-partisan district-drawing process, and it has zero split census tracts. You don't need to split census tracts to make compact districts. You don't need to do it for contiguous districts, and so forth. It suggests the reason was that partisans were chosen for splitting from their neighbors for purposes of partisan advantage.
Q. At this time, let's look at your examination of specific map areas. We'll focus on the specific areas that you report on in your study.
MS. LEVENSON: First, Stephen, could you please put up Plaintiffs' 59. I'm sorry, Plaintiffs Demonstrative 59. Thank you.

Q. Dr. Niven, could you describe what District 1 was like under the previous decennial map?
A. This is a depiction of District 1, as you said, under the map that was previously in effect. It included much of Hamilton County and parts of Butler County. And, notably, it was a competitive district. It was a district that swung back and forth. Republicans won it in 2006, Democrats in 2008, Republicans in 2010. One academic analysis of the district called it a textbook example of a marginal district. So this was a district that could go either way in a given election.
MS. LEVENSON: Now, Stephen, could you please put up Plaintiffs' Demonstrative 60.
Q. Dr. Niven, what do you observe about District 1 under the current map?
A. Under the current map, two things stand out, certainly. One is the -- the very surgical effort to split Hamilton County. As you can see, it's quite an unusual shape with kind of a -- kind of a reverse Italy shape going on there.
But then, of course, notably, Warren County was added to the district. And what you get then is a Hamilton County where Democrats are the preferred party of most voters and then you bring in Warren county which is overwhelmingly Republican. And what you have the effect of doing here, of course, is negating that -- that Democratic stronghold in Hamilton County with the folks in Warren County.

And one thing that I would point out is, if you were to draw a district within Hamilton County, if you drew one district within Hamilton County, it would have to be a district that leaned Democratic. Because of the nature of Hamilton County, there aren't enough -- there aren't enough Republicans in Hamilton County in any way to draw a district that would produce a Republican advantage.

So if you wanted to avoid the outcome in which a Democratic Hamilton County elected a Democratic representative, the only way you could achieve that is by dividing Hamilton County into pieces and then adding chunks of other counties in its proximity.

Q. How do you know that you could not -- let me back up for a second. Could -- could -- is Hamilton County --

Could Hamilton County, the entire county, fit into a congressional district?

A. No. You would need to take at least a portion of Hamilton County out in building a district because the population of Hamilton County is too big.

Q. So you're saying it had to be divided up. How do you know that it couldn't be divided up in such a way that it could produce a Republican or neutral district?

A. What I did was take Hamilton County as a whole and systematically remove the most Democratic towns one by one from Hamilton County until I was at a point where the remaining

population was the same as a congressional district, and then --

JUDGE BLACK: Excuse me.

MR. McKNIGHT: I'll just note an objection here, because I am unaware of anything about a map or him drawing maps being in his report.

JUDGE BLACK: All right. The objection's noted. Plaintiff can --

MS. LEVENSON: For the record, this is in Dr. Niven's report.

JUDGE BLACK: The Court will determine that.

MS. LEVENSON: Yes. Yes, Your Honor.

JUDGE BLACK: Very well.

A. As I was saying, in a very simple process, as I discuss in my report, I took the whole of Hamilton County, identified the most Democratic towns in Hamilton County in terms of the percentage vote for Democrats, removed them one by one until what was left was a population the size of a congressional district. And having removed the most Democratic towns from Hamilton County from this district, what was left was still a Democratic-leaning district. So there was no way to construct a district within Hamilton County that didn't lean Democratic.

MS. LEVENSON: Thank you.

Stephen, could you now please put up Plaintiffs' 524, page seven, the table on that page. That's tab 2, page seven.

Q. So what was the partisan character of Warren County, the county that was added to the cracked portion of Hamilton County?
A. Well, as you can see here, Warren County is an overwhelmingly Republican area and Hamilton County is a reliably Democratic area at this point.
Q. So when Cincinnati and Hamilton were cracked and Warren County added, what happened to the formerly slightly Democratic-leaning 1st District?
A. Well, the partisan voting index, for example, of the old district was D+1, which means that it very slightly favored Democratic candidates. In the new district as it was originally proposed, this became an R+6 district, which is to say a district that was meant to be safely and reliably Republican. And now we know subsequently that it has performed that way. Its current number is R+5, which is to say a -- what the map drawers considered to be a safely Republican district.
Q. Can you very briefly explain what the partisan voting index is since you've referred and will be referring to it.
A. The partisan voting index, it's something that political analyst Charlie Cook coined and others have adapted. It's essentially a look at how any political area, in this case a congressional district, performs relative to national averages.
So a place where a district has an R rating, it means it's voting at a higher rate than the nation as a whole for

Republicans. If it has a D rating, it's voting at a higher rate than the nation as a whole for Democrats. And the score is based on how that area voted in the last two presidential elections.

Q. What did the change in District 1 mean in terms of representation for the district?

A. Well, this gets to one of those fundamental aspects that Richard Fenno's research is about, that all constituents are not created equal. And the change in this district was very dramatic in terms of taking out all -- what was the Butler County portion of the district and putting an entirely new county, Warren County, into the district. And the effect is that Congressman Chabot openly thanked the legislature for giving him Warren County, boasted of his love of Warren County. Which is exactly what Fenno warns is going to happen: that a member of Congress isn't going to see everyone equally, he's not going to see every area equally.

And when a member of Congress goes around thanking the legislature for a new county and touting his love of that county, that's exactly -- that's exactly what Fenno is warning about, that there are places that are central to a member's awareness, central to, indeed, their heart, and that's what was achieved in the recreation of District 1.

MS. LEVENSON: Stephen, can I ask you to put up Plaintiffs' 524, page eight, the table in the binder that's tab

2, page eight.

Q. This table appears in your expert report, Dr. Niven. Can you explain it.

A. This table is an illustration of the power of redistricting. In the first column you see how the 1st District voted in the 2008 presidential election. In the second column you see how the new 1st District voted in that same election.

So what this is showing is that without winning a single additional vote, without the benefit of a single, you know, campaign strategy or outreach effort or anything to reach voters, the 1st District was transformed. A district that had voted for the Democratic candidate became a district that voted, in that same election, for the Republican candidate. And that was -- that was the whole point of the transformation of the 1st District: to take it from something that had slipped into that Democratic category and make it, again, more safely Republican.

Q. So this is your view from now, here and now, as to what happened. Could the map drawers have seen this?

A. This is, indeed, the data that the map drawers had available to them in 2011. And, you know, we know from e-mails among the staff involved in drawing the maps that some favored exactly this measure, just a straight presidential election outcome, as an indicator of what the districts would do. And,

indeed, as you can see in that right column, the Republicans won the district by five percent and, now, you know, more than a decade later, it's stilt an R+5 district. It's doing exactly what it was intended to do.

MS. LEVENSON: Stephen, could you put up 524, page nine, the chart at the top of the page. That's tab 2 page nine.

Q. So I'd like to ask, in the process, what happened to the 2nd District.

A. Well --

Q. Oh, just before you speak, Dr. Niven, I'm sorry.

MS. LEVENSON: I want to point out to everyone that there is a typo in the very top line of the table. The title of the table is correct. It's Old 2nd vs. New 2nd. The top line in the table itself says Old 1st, New 1st, but it's Old 2nd, New 2nd. Thank you.

Q. I'm sorry. Let me repeat the question. In the process of doing this to the 1st District, what happened to the 2nd District?

A. Well, interestingly enough, the 2nd District becomes something of a donor district. It had more Republicans than was needed to ensure a safe district. And so as you can see on the left column, it was voting, you know, 59 percent Republican in the presidential election, and in the right column that number actually was reduced to 55 percent. You know, why

would -- why would the map drawers ever do that? They would do that because they had too big a majority in the 2nd District, so they had Republicans to donate, in this case, to the 1st District to shore it up.

And so, you know, this is the very nature of mapmaking. You don't -- you know, you don't want to create as big a majority for yourself in every district, because that wastes too many votes. You want to apportion those voters, ideally, so that you have safe majorities in as many places as possible. And that's why the 2nd District became a donor district of Republicans to the 1st District.

MS. LEVENSON: Plaintiffs' 524, page nine, the table in the middle of the page, that's binder tab 2, page nine.

Stephen, could you please highlight the column regarding Hamilton County. That's on the left.

Q. So, Dr. Niven, could you explain exactly how this happened to the 2nd District, how it became a donor district and what happened to it.

A. Well, what you see in this table is, again, illustrative of how a Democratic Hamilton County could wind up with two Republican representatives.

So as you see in this table, the highlighted portion, that's Hamilton County, again, an area that voted and continues to vote for Democratic candidates. It was then paired with Adams County, a Republican county; Brown, a Republican county;

Clermont, a Republican county; Highland, a Republican county; Pike, a Republican county; Ross, a Republican county; Scioto, a Republican county. It was paired in such a way that the Democrats of Hamilton County, of course, would be outnumbered by all of these voters across all of these other counties.

So what's notable is when you add what happened here in the 2nd to what happened in the 1st. You take a Democratic county, a county that on its own would elect a Democratic member of Congress and you split it in such a way to dilute the value of those Democratic votes and bring in Republicans from the outlying counties and you thus get, you know, a strongly Democratic county with two Republican members of Congress.

Q. So now you've described how Hamilton County was cracked. Let's take a closer look at how this was done, what you see when you actually study the district lines.

On Plaintiffs' 524, page nine, the bottom of the page -- that's tab 2, page nine of the paper version -- what does this show, Dr. Niven?

A. This is just a list of cities and townships that were split between the 1st and 2nd District. It's just illustrative of the fact that when they split Hamilton County, they weren't just, you know, splitting off what they had to -- to -- you know, for population purposes. Instead, they were making continual splits, strategic splits such that cities big and small wound up split between the 1st and 2nd District. And

this is, you know, illustrated in the map itself with its jagged edges and its you know, its boot shape and so forth.

You know, this was -- this was not a split of Hamilton County between the east side and the west side or the north side and the south side. It was, of course, you know, a jagged-edge split that interrupts many different localities.

Q. Plaintiffs 524, page 12, the table. So on your list was even the Cincinnati -- the city of Cincinnati itself was cracked between Districts 1 and 2. Can you describe how that occurred?

A. Well, when you say that -- that a city is split between districts, it can kind of mask the depth of the splitting. And Cincinnati is a great example of what the cost of gerrymandering really represents, because Cincinnati formally recognizes neighborhoods, and while every town might have --

Q. Did you say formerly or formally?

A. Formally recognizes neighborhoods. While every town might have, you know, designations, you know, for different areas, Cincinnati formally recognizes 52 neighborhoods and builds city policy around those neighborhoods, and, you know, candidates campaign to and for those neighborhoods.

So when you say you split Cincinnati, you know, you might -- you might miss the distinction that you're also splitting pieces within Cincinnati, and so this table reflects the fact that 14 Cincinnati neighborhoods were split between

the 1st and 2nd District. Again, this is not an east-west or a north-south drawing of lines. This is jagged edges that cut through neighborhoods.

And in particular, what I observed in these neighborhoods is that they were more Democratic than the city as a whole. They were more Democratic than the county as a whole. And so, in an effort to surgically assign Democrats to the two districts in a way that they would not cause the consequence of losing an election, these neighborhoods were targeted for splitting.

Q. Moving to plaintiffs 524, page ten, the map on that page, tab 2, page ten. So what does this show?

A. This is an example of what this means in practice, to say that you're splitting Hamilton County, that you're splitting the city of Cincinnati, that you're splitting neighborhoods. This is in the College Hill neighborhood, and what this shows is in the -- where the arrow indicates, that the width of the 2nd District in places is no more than a single house.

What you see here in the shaded area is the 6th District, the unshaded area is the 1st District. And, as an example here, 1077 West North Bend Road, if they walk out their front door, their first steps are in the 2nd District, but then they're in the 1st. If they walk out their back door, again, the same thing happens. The district is essentially their house in that spot.

And this kind of splitting, you know, neighbor from neighbor, you know, is emblematic of, you know, the treatment of places like Cincinnati that needed to be split for the purposes of partisan advantage. And once -- once the map drawers went down that road, it became as much as, you know, a house-by-house assignment of voters.

Q. So what, if any, implications would splitting a neighborhood have on its ability to achieve effective political representation?

A. Well, again, what you're -- political science research tells us is that being in this kind of isolated circumstance exacts several different costs. I mean, it exacts the cost of the demobilizing effect, because it's confusing when you look outside your door and the yard signs are for candidates you can't vote for. It's a demobilizing effect when organizers, you know, tend to write off areas that are isolated in a district, so they're less likely to contact those voters and try and get them out to vote, and it's an effect that compromises the representational relationship. You know, there's a reason why Congressman Chabot would be thanking the legislature for Warren County and, you know, why his hometown would be subject to this splitting, and it's because his hometown wasn't politically advantageous to him.

Q. Thank you. Let's move now to another area of the Congressional map that you studied, the 9th District,

Plaintiffs' 524, page 14. Tab 2 page 14, the photograph.

So this is your illustration of Florence Township. Why did you lead the discussion of District 9 in your report with this?

A. I think Florence Township is a good example of the practical meaning of -- of gerrymandering, because you all had to deal with an awful lot of data, and I'm inflicting a little bit more data on you here today, but beneath all that data are actual Ohioans and their life experiences. That's really what we're talking about here.

And Florence Township interested me because it's something of a quintessential small town, just over 2,000 people living on streets that were -- that were laid out by the town founder Ebenezer Jessup 200 years ago, you know, something of a quintessential small town, a small town such that it's news in town not that they got a post office but that they got a mailbox. This is -- this was the front page of the town Web site heralding the arrival of a mailbox.

And what struck me about this example was that were the residents of Florence Township to go to their one mailbox to write a letter to their member of Congress to express an opinion or ask for help, as those residents of Florence Township went to their one mailbox, they'd be writing to two different members of Congress, because tiny little Florence Township was split between multiple congressional districts.

It's emblematic of the design of the 9th District in the

first place, which is, it's built on splitting. It's almost defined by a relentless commitment to splitting counties and communities for the purposes of -- of drawing this very peculiar district.

Q. So District 9 contains pieces of how many counties?

A. Five counties.

Q. And how many of these five counties are whole?

A. None of the counties in District 9 are wholly intact within the district.

Q. Let's look at Plaintiffs' 524, page 15, the bottom table. So how many cities, townships and villages are partly in District 9?

A. Twelve.

MS. LEVENSON: Can you keep this image up, please, Stephen.

Q. So of these cities and towns, which had a population large enough to require it being split in multiple districts?

A. None of them do.

Q. By the way, what's the size of a congressional district?

A. It's approximately 721,000 people.

Q. 720--

A. 721,000 people.

Q. 721,000. So what are the accepted rules for drawing district lines?

A. Well, generally speaking, there's a hierarchy that the

districts need to be equal in population. The districts should be compact and contiguous. The districts should hold communities of interest intact. The districts should not needlessly divide political subdivisions, such as counties and towns and townships. The districts should not deny or dilute minority voting opportunities. These are the sort of major -- major premises of district drawing.

Q. Thanks.

MS. LEVENSON: Stephen, could you please put up Plaintiffs' Demonstrative 61. And could you adjust the map so that District 11 isn't on it so that we just look at District 9. Thank you.

Q. Okay. Dr. Niven, you've just recited accepted rules for drawing district lines. Given those rules, what's the rationale for splitting up all of the municipalities that we just saw on that list?

A. Well, it wasn't in service of a compact district and it wasn't in service of a contiguous district, as you would obviously need to walk on water to stay in the 9th. It wasn't in service of a district that held communities of interest whole. This is a district that divides relentlessly. It wasn't in service of an effort to hold political subdivisions whole. This is obviously a district that cuts counties and towns into pieces.

So we're running out of explanations for what would

motivate District 9, which leads us to this is a classic effort at packing, taking the disfavored party's supporters and packing them as tightly as possible into a district so as to make surrounding districts more reliably, in this case, Republican.

Q. Plaintiffs 524, page 15, the top table that's tab 2, page 15. So you how does District 9 treat county borders?

A. It basically disregards county borders. This is a district where each of the counties within the district has been sliced into multiple pieces, and, as you can see here, in the cases of Cuyahoga and Lorain, sliced into more than two pieces. And none of the counties in the district, of course, were allowed to be in their entirety in the district.

Q. So you've discussed the carving up of five counties and multiple municipalities in creating District 9. What did you notice about the way District 9 combines communities?

A. Well, what District 9 does is, it takes areas that are pretty far apart from each other and combines them. You know, Cleveland and Toledo are officially recognized by the state of Ohio as being in different economic areas. When the state creates economic policy for Toledo, it's explicitly not creating economic policy for Cleveland, because they're -- they're classified as being in different regions.

These are places that have a different industrial and economic mix. These are places that even have a different

cultural mix. I mean, it perhaps can't be better illustrated in the context of the average Ohioan than saying people in Toledo are several times more likely to root for the University of Michigan than people in Cleveland. These are very different places.

MS. LEVENSON: Plaintiffs 524, page 17, the table, tab 2, page 17.

Q. Can you describe how Cleveland and Toledo differ economically in terms of employment?

A. Well, this table represents some census data. The census reports on what they call overrepresented and underrepresented occupations, and that's basically how prevalent is an occupation relative to statewide averages. So an overrepresented population is something that a, in this case, county has in greater number, greater likelihood than the state overall underrepresented is something that the county has in less frequency than the state as a whole.

And so you can see some really stark differences in occupations that wind up overrepresented and underrepresented here. In Cuyahoga, fueled in part by the Cleveland Clinic, by NASA Glenn and the universities, science is an overrepresented occupation. If you go to Erie and Lucas, science is underrepresented. And, again, the stark contrast. In Ottawa County farming is overrepresented and, not surprisingly, in Cuyahoga County, farming is underrepresented.

So what this table illustrates, just a quick shorthand, is that these are not five counties with, you know, a very similar economic outlook and a very similar profile. Instead, these are -- these are distinct places that were knitted together in -- at least portions of them were knitted together.

MS. LEVENSON: Plaintiffs 524, page 18, the map. Tab 2, page 18.

Q. So what does this show?

A. This is actually the Ford Ohio Assembly Plant in Avon Lake, and the shaded area is the 9th District, the unshaded area is the 4th District. And this is just an illustration of what line drawing and gerrymandering means in practicality. The commitment to splitting is so profound that the Ford Ohio Assembly Plant itself was split into pieces between the 4th and the 9th District. The plant makes pickup trucks. So those pickup trucks will go into and out of the 9th District as they're being constructed.

Q. So what do you make of the carving up and recombining that went on in to create District 9? What does that tell you?

A. Fundamentally, you know, this is a textbook case of packing. By virtue of putting Democratic areas in these five counties together, it has the consequence of allowing the surrounding districts, 4, 5, 7 and 16, to be more reliably Republican. And so by virtue of a willingness to relentlessly split these places and to, of course, knit them together in the

first place, what you get is a very confusing district that has drawn national acclaim. I mean, this is the kind of district that shows up in national reports of the worst examples of gerrymandering. And it does so because it doesn't honor any of those objectives. It's not compact, it's not contiguous, it doesn't hold communities of interest together, it doesn't hold political subdivisions together. Instead, what it does is, it -- it very effectively achieves a packing scenario that means this is a district that's very reliable for Democrats, and the surrounding districts all become more safely Republican.

Q. Let's move to a third area on the Ohio map, Franklin County, where new District 3 was created out of parts of former Districts 12 and 15.

MS. LEVENSON: Stephen, could you please put up Plaintiffs' Demonstrative 63.

Now, Your Honor, I know that there's an objection to this demonstrative, so I'd like to establish foundation.

JUDGE BLACK: Very well.

Q. Dr. Niven, what does this image represent?

A. This is a map of Franklin County and the representation of the current congressional districts under the current map.

Q. Does it accurately portray Franklin County with its current congressional districts?

A. Yes.

MS. LEVENSON: I now move to use this demonstrative.

JUDGE BLACK: Any objection?

MR. McKNIGHT: No objection, Your Honor.

JUDGE BLACK: Very well.

MS. LEVENSON: Thank you.

JUDGE BLACK: You may use it.

MS. LEVENSON: Thank you.

Q. Dr. Niven, what observations did you make about the city of Columbus and Franklin County, in general?

A. Well, again, what you have here is a very Democratic county, in this case, the second-most reliably Democratic county in the state. And what was achieved in these rather odd-looking districts is that a very Democratic county winds up with two Republican representatives out of its -- out of its three members of Congress.

And, again, it's a glorious illustration of what cracking and packing means on the ground. When you look at that district, it doesn't look like any shape you would ever encounter in nature, and it certainly doesn't look like any natural set of geographic boundaries.

Q. So to orient everyone, where is District 15 on this map?

A. District 15 would encompass the, we'll call it the southern and eastern portions of the map, and it's in -- I'm not very good with colors, but let's say something -- something purplish. District 12 is the northern part of the map. And

then District 3 is the greenish-yellow ink blot in the middle.
Q. Okay. Let's examine these three districts here in turn. What was the 15th District like under the previous decades map?
A. The 15th District, very much like the first district, was a very competitive district. And, again, very much like the 1st District, it was one that had been flipping between parties. In 2006, it was won narrowly by Republicans in 2008, it was won very narrowly by Democrats in terms of the House seat. In 2010, it went back to the Republicans. It was rated a D+1 just like the 1st District, which is to say a very slight Democratic- leaning district.
Q. In the drawing of the new map in 2011, what happened to District 15?
A. District 15, much like District 1, was transformed, and, in very much the same way, it went from a district that was just ever so slightly leaning Democratic to one that was expected to be reliably Republican.
Q. What was moved into the district to compensate for the lack of population from District 3?
A. Well, District 15 -- it's not visible on this map, but District 15 winds its way from the city of Columbus and Franklin County on a journey that, in terms of total circumference, runs more than 900 miles. It adds a portion of several Republican counties and then it adds the entirety of several Republican counties, stretching out from Columbus down

into southeast Ohio.

MS. LEVENSON: Plaintiffs' Demonstrative 58, please.

Q. Dr. Niven, this is a demonstrative created with some of the data in your report. What does this list consist of?

A. This is a list of cities, townships and villages that are split between the 15th and another district. And, again, what you're seeing here is a willingness to utterly disregard municipal boundaries, utterly disregard these communities and treat their -- treat their boundaries as -- as irrelevant to the process of drawing districts.

And, again, to maximize advantage, you have to be willing to impose these splits. If you don't impose these splits, then you get what you get. And, you know, where Democrats are the majority in the county, they're going to elect Democratic members of Congress. But if you're willing to impose these splits, you can get what you want, and that, you know -- that is what we see in the 15th.

MS. LEVENSON: Can we please see Plaintiffs' 524, page 20, the table. Tab 2, page 20.

Q. So, Dr. Niven, what does this table show?

A. This table is illustrating sort of the premise and purpose that we saw earlier when we looked at the number of census tracts that were split between the old map and the new map, and so this is a specific example of where that came from and how that happens.

And so what this table is showing simply is under the old map, there were only 41 census tracts split. Under the new map, under a much more strategically drawn, surgically drawn map, that total rises to 72. And this is where that statewide pattern comes from, places like this where, in an effort to impose partisan preferences for maximum effect, splits had to be made, and, indeed, they were made here.

Q. What did you observe about the populations who were put together to compose the new District 15?

A. Well, District 15, again, not unlike District 9, spans areas that don't necessarily have the most obvious common interests. And again, this is something that is going to alarm -- set off alarm bells in light of research by Fenno and others.

So what this means in practice, Franklin County is, relative to the state, unusually diverse, unusually wealthy, unusually well educated, overrepresented occupations include things like law and business and science and math and computers.

This District 15 stretches from Franklin County down to Vinton County where, you know, overrepresented occupations include things like movers and healthcare aides where, by contrast to the state, you know, average incomes are below average, where education is below average, where -- where ethnic diversity is less than the state as a whole. So what

you get is a district of very disparate places. And what Fenno's research would suggest is some of those places are going to get forgotten in the process, because you can't represent, you know, opposites equally.

MS. LEVENSON: Plaintiffs' 524, page 22, the upper table.

Q. So how did the new District 15 differ from the old 15 electorally?

A. Well, again, this is the magic of redistricting. Without the benefit of gaining a single additional supporter, without the benefit of gaining a single additional vote, you transform the 15th from a district where the Democratic candidate won in 2008, comfortably, to a district where that same election, but now you've chosen new voters for it, where the Democratic candidate loses handily to the Republican candidate in the new 15th. And you go from an old 15th, where the Republicans couldn't depend on winning, to a new 15th where they can depend on winning.

MS. LEVENSON: Plaintiffs' 524, page 24, bottom table. That's table tab 2, page 24.

Q. So let's consider mechanically how that transformation was done. What did you observe about the characteristics of the voters who were retained in 15 versus those who were moved into 15 versus those who were moved out of 15 to create the new 15?

A. Well, this is something I think is one of the most

fascinating parts of how gerrymandering works. If you look at this table, the three columns, Removed, Retained and Added to the 15th, so -- this is all within Franklin County, and it's almost something of a, you know, outcome of the selection board process here. Who is worthy of the 15th?

And you'll notice in the first column, Removed from the 15th, that the people who had been in the 15th and were exiled from it were overwhelmingly Democratic, were overwhelmingly Democratic. They were not permitted to keep their representative. They were not permitted to stay in district.

You go to the next column, the people who got to stay, were basically even, 50-50, between Democratic and Republican voters.

You go to the right column, the newly added voters to the 15th. So these are people who had not been in the 15th previously were overwhelmingly Republican.

This is a pretty stark example of just what it means, that you didn't just slice Franklin County into three random pieces, you didn't just, you know, make three piles and see how things fall. This is a rather stark example of your ability to qualify for the 15th District, depending on your partisanship.

MS. LEVENSON: Stephen, could you please navigate down to Footnote 57 at the bottom of the page.

Q. So, Dr. Niven, what's the likelihood of that sorting occurring by chance?

A. Well, as you can see here represented in the footnote, and as I mentioned earlier, in social science we like it when something has a one-in-20 chance. We're very happy at one in a hundred. We're thrilled at one in a thousand. You get past one in a thousand and it's -- it's almost -- almost unheard of. This is not one in 20, one in a hundred or one in a thousand. It's not one in a million, it's not one in a billion, it's not one in a trillion. This is not even one in a googol, which is one in 100 zeros. I've lost track of how many zeros are in this.

But as a practical matter, if you were to divide Franklin County into three pieces, the likelihood that you would get one pile that's Republican, one pile that's even, and one pile that's Democratic is the number that you see in front of you, which is an astronomically small number. It is vastly beyond -- for example, your odds of winning Powerball are far, far greater than -- than achieving this by chance. And, indeed, you would be more likely to win Powerball week after week after week than to get this number by chance.

Q. So if you reject the possibility that the sorting occurred by chance, what is the conclusion that you reach?

A. The conclusion that I reach is that this was done for partisan purposes, that -- that Republican mapmakers utilize a partisan division for the purposes of partisan advantage. And what this number shows us is there is, in practical terms, no

chance that this occurred randomly, that this occurred accidentally.

Q. So we've been looking at the area where the new District 3 was carved from and its impact on the 15th Congressional District. Now let's look at the impact on the 12th District.

How was the 12th District then constructed?

A. Well, the 12th District, again, what are you going to do with a Democratic county? If you leave it to its own devices, it's going to elect a Democratic member of Congress.

If you don't want that to happen, you have to combine the district from Franklin County into more Republican areas. And so in the 12th they added or continued to have Delaware, Licking and Morrow County and several other strongly Republican counties, again, to create the effect of a reliably Republican district.

MS. LEVENSON: Stephen, can we please see Plaintiffs' 524, page 25, bottom table. That's tab 2, page 25.

Q. So what was the effect on District 12 of taking parts of Franklin County out and adding those strong Republican areas?

A. Well, the overall effect was to take a district and increase its -- its Republican reliability. The table that's being highlighted here is -- is the exact same setup that we just saw in the 15th District: who got to stay in the 12th, who was removed from the 12th, who was added to the 12th. And, again, you see a very, very dramatic difference.

Who was removed from the 12th? Overwhelmingly, it was Democratic voters were removed from the 12th. Who was retained in the 12th? Again, here, it was Republican voters. And added -- in this case, there was -- Democratic voters were added, but only because there were so many -- so many Democrats removed, that that could be -- that could be achieved without any damage. You know, this is -- again, this is all relationships here. So the 12th was safer than the 15th, so the 12th could get a few more Democrats than the 15th.

And in both tables you'll notice at the bottom, how did this affect the Republican margin? And this -- this little bit of math, ultimately, added 67,000 votes of safety and comfort for the Republican candidates just within Franklin County.

Q. Thank you. So let's talk about how the new district -- about the new District 3 itself. What did you observe about the population placed into District 3?

A. Well, District 3, again, is a classic packing example. As you could infer from the previous tables, it's an overwhelmingly Democratic district. It's where Democrats were exiled from the 12th and the 15th to make those two districts safely Republican.

MS. LEVENSON: Let's move now to Plaintiffs' 524, page 26, the map on that page. That's tab 2, page 26.

Q. So we're talking now about something within District 3. What does this show you?

A. Well, this is, again, an example of the way that in practical -- in practical life, these maps are imposed on people. It's not showing it very clearly, but that arrow points to a house. Again, a situation in this case, in the 15th District, where the entire width of the 15th District is a single house. And the folks who live at 58 Renner Road, their front yard, their backyard, their side yard, all open to different congressional districts.

It's an illustration of which, across the state, there are countless of these, you know, sort of divisions of neighbor from neighbor for strategic purposes. You know, far from holding counties intact, far from holding cities in intact, far from holding neighborhoods intact, you know, this is an illustration that you don't necessarily get to stay intact with your neighbors in a congressional district.

MS. LEVENSON: Let's look at Plaintiffs' 524, page 27, the map. Tab 2, page 27.

Q. So what's this shape, Dr. Niven?

A. This is one of my favorite shapes. I've thought of it as kind of an absurdist chicken or possibly a head on a pedestal, but this is a boundary between the 3rd District and the 12th District. The 3rd District is shaded, the 12th District is unshaded.

And when you look at that, you would say, Well, what could you people have meant to do? Why would you create a shape of

such an absurd nature? And one observation I would make about this particular shape is that somewhere near the head of the chicken resides the local Democratic state representative, who also happened to be the former chair of the Democratic party in Ohio. And in the 3rd District, he is not someone who can harm Republican interests, because the 3rd District is a packed Democratic district. It's already written off.

In the 12th District, he would represent a potential candidate for Congress, a potential, you know, well -- well-regarded, well-equipped candidate for Congress. So it certainly would be strategically advantageous to put him in a place where he could do no harm, and if you happened to need to draw a chicken shape around his house, you know, so be it, and that's what we see here.

MS. LEVENSON: Stephen, could you redisplay Plaintiffs' Demonstrative 63.

Q. So, Dr. Niven, why did you include those selections of weird shapes in your report?

A. Well, I think that when we look especially at the map as a whole, when we look statewide, that it's hard to appreciate in the most granular detail the number of cuts necessary to achieve these effects. That even when you're looking here at just Franklin County, it's hard to appreciate just how jagged the lines are. And, in fact, you know, that single house on Renner Road is too tiny to even show up on a map like this, so

you can't appreciate the degree to which, you know, street by street, house by house, people can be divided without zooming in a little bit and seeing what these shapes look like close up.

Q. Did you review the report of Dr. Thomas Brunell filed by the intervenors responding to your expert report?

A. I did.

Q. How do you respond to Dr. Brunell's assertion that funny-shaped districts are inevitable?

A. Well, I believe that funny-shaped districts, you know, are neither amusing nor inexorable. They are a strategic choice. They are an imposition that is done for the purposes of political advantage.

There is no particular reason that you need to jaggedly cut up Cincinnati, yet it was done. It was a funny shape by choice. There is no particular reason you need to cut up Franklin County in this manner, yet it was done. It was a political choice.

And I think what's very important to understand, whether it's in the absurdist chicken shape or on Renner Road or North Bend Road is there are real people, real Ohio voters represented here, and all this mapmaking is done as a cost to their representation. You know, this isn't just sort of a trivial illustration of funny shapes, this is an illustration of division, and it's one that was imposed relentlessly across

Ohio, and it was one that was imposed with partisan tinge such that democrats are far more likely to have found themselves in the midst of these cuts and divides.

Q. Can you tell us how the cities of Franklin County fared under this map?

A. Fourteen out of 16 were split between congressional districts.

Q. These map pieces that you pointed out, the ones that interlock in irregular ways --

MS. LEVENSON: Stephen, can you zoom into this map just a little bit.

Q. -- how does that function in practice?

A. Well, we have some -- some notable information about how this functions in practice. We had a special election in the 12th District in 2018, which is represented in this particular depiction -- again, it's the top left lighter purple -- a special election. And thousands of folks in Franklin County called the Franklin County Board of Elections and asked on Special Election Day why their local polling place wasn't open. They wanted to cast a ballot in the special election in the 12th district. And the answer that they were given is the reason their local polling place wasn't open for the special election in the 12th District is they didn't actually live in the 12th District.

And this is precisely the cost of drawing districts in this

manner. It's inevitably confusing. If your town isn't united in a congressional district, that's confusing. If your neighborhood isn't united in a congressional district, that's confusing. And it's not theoretical. We know these people were confused. They thought they had an election to vote in and, really, how could we blame them? Looking at this map, how would you know which district you would -- you would live in, especially if you were anywhere near any of these jagged edges?

Q. So what, if anything, was learned as a result of this special election?

A. Well, in some regards, that example actually understates the problem, because in the midst of that special election, one voter called the Board of Elections in Franklin County and inquired about his own congressional district assignment, wondered if it was correct or not, and the board ultimately looked into the matter and found that it had misassigned voters to congressional districts in Franklin County. And they came to this conclusion in 2018, which means that these voters had been voting in the wrong district in 2012, 2014, 2016. Thousands of voters misassigned.

These are not just people who are uninterested in politics getting confused. These are the professional administrators of our elections being confused about which district a voter is in. How could they possibly have been confused? Well, look at this map and you can see how they can possibly be confused.

But, more directly, they can be confused because boundaries weren't respected. When you respect the boundaries of a municipality, for example, the misassignment of voters would have been possible.

Q. How many voters --

JUDGE BLACK: I'm sorry, we have counsel standing.

MR. LEWIS: We would move to strike that portion of the answer. The witness does not have foundation. A foundation has not been laid for the testimony offered about allegedly misassigned voters in the 12th district.

JUDGE BLACK: Objection's noted. If you want to lay a foundation, go ahead. If you don't, so be it.

Q. Dr. Niven, as a political scientist who does empirical research, what type of data do you rely on in your work?

A. I rely on public opinion data, I rely on election data, I rely on census data, and I rely on -- I do analysis of news coverage as well.

Q. What was -- did you review media and news with respect to the election of -- in the 12th district, the special election in 2018?

A. I did.

Q. Did you study that information as you typically would with regard to your other scholarship in this area?

A. I did.

Q. Thank you.

How many voters were affected by the Board of Elections mixup?

A. Approximately 2,000, according to the Board of Elections report.

Q. Thank you. Let's move to one last section of the state map, Summit County.

MS. LEVENSON: Stephen, could you put up Plaintiffs' Demonstrative 62. And I note that there has also been an objection lodged to this demonstrative, that I hope to use, for lack of foundation. May I establish foundation for it?

JUDGE BLACK: Yes.

Q. Dr. Niven, what does this image portray?

A. This image portrays Summit County under the current congressional map, and, as you can see, it's divided between four congressional districts and divided, again, with some unusual shapes in between.

Q. Does it accurately portray Summit County and its division into congressional districts?

A. Yes.

MS. LEVENSON: Thank you. I move to use this map as a demonstrative exhibit.

MR. McKNIGHT: No objection, Your Honor.

JUDGE BLACK: Very well. You may.

MS. LEVENSON: Thank you.

Q. So, Dr. Niven, what did you observe about Summit County

under the congressional map?
A. Well, what you see in Summit County, again, is a disregard for county boundaries. Summit County is a county that could fit entirely within one congressional district based on its population size, but, instead, it's not in one district, it's not in two and it's not in three. It's cut into four pieces. And, indeed, those four pieces are not representative of the county as a whole. There are, in effect, two pieces that are more Democratic than the county as a whole and two pieces that are more Republican than the county as a whole, suggesting that Summit County was used for the purposes of -- of packing and cracking.
Q. So you say that Summit County is too small for its own district. Did you perform any analysis as to what would happen if it were simply paired with any contiguous community to create a large enough district for a congressional district?
A. I did. I took Summit County and added contiguous counties that would produce the correct population total. And what you do -- what you find when you do that is, any combination of counties that were added to an intact Summit County would have produced a Democrat-leaning district, because the margin of support for Democrats in Summit County is larger than the margin of support for Republicans in any contiguous county and/or some of those counties support Democratic candidates.
MS. LEVENSON: Stephen, could you please put up

Plaintiffs' 524, page 32, the top table. That's tab 2, page 32.

Q. So how did these new districts sort the voters of Summit County?

A. This is just an illustration. This is an index of four elections. Again, the higher the number, the more Republican. So one would be a completely Republican district, .0 would be a completely Democratic district.

And as I mentioned a moment ago, there was a very distinct difference in the voters assigned to the 11th and 13th versus voters assigned to the 14th and the 16th. And so what you can see here is voters in the 11th were overwhelmingly Democratic in orientation, voters in the 13th were strongly Democratic, and then in 14 and 16, despite this being a Democratic county, the voters assigned to those two districts were actually the more Republican-leaning areas of Summit County.

MS. LEVENSON: Stephen, could I ask you to go back and put up the demonstrative again. Just rewind to Plaintiffs' Demonstrative 62.

Q. So was this sorting done in a neat way?

A. Well, as you can see, again, very much like the Franklin County confusion, what you can see are these -- these tentacles emanating from and between these districts in a way to, you know, ultimately maximize division and maximize confusion in Summit County.

I mean, to look at this map, again, it's not just that Summit County was cut into four pieces, which is an imposition in and of itself, it's cut into four, you know, utterly, you know, unnatural pieces. You know, none of these four portions of the county accurately reflects the county as a whole. None of these four accurately reflects the county's voting as a whole. You know, this is -- this is a textbook gerrymandering circumstance in which, first of all, you impose a division on the county that's unnecessary to begin with, and then you -- you do so not, in effect, in a -- you know, natural way. You didn't just divide the country into north and south and east and west, but, instead, you created these, you know -- these array of tentacles that reach across and through the county and the cities within it.

MS. LEVENSON: Turning to plaintiffs' 524, the page 32, the bottom table. Tab 2, page 32.

Q. You previously described the phenomenon across Ohio census tracts of dividing Democratic voters much more frequently than Republican voters. To what extent did that happen, specifically, here in Summit County?

A. Well, this is an illustration of exactly what we talked about earlier, that more Democratic areas were more likely to be targeted for splitting. And so here what we have is an already Democratic county, it's a county that supports Democratic candidates, but even within that Democratic place,

the more Democratic areas were more likely to be targeted for splitting between congressional districts. So this is -- this is an illustration of how that -- where that relationship originates and what, you know, what the nature of it is. It's about the strategic splitting of Democrats in places where, left intact, they would be a politically potent force.

You know, Summit County left intact is a place that produces a Democratic member of Congress. Summit County split into pieces dilutes that power such that, you know, you wind up with two Democrats and two Republicans. It's very much the same principle that we saw in Franklin County and in Hamilton County. You know, that strategic splitting dilutes that relationship.

Q. Dr. Niven, there was one other analysis that you performed, a study of the location of congressional district offices.

MS. LEVENSON: That's plaintiffs' 524, page four, which is tab 2, page four, illustrated by this map.

Q. Can you kindly explain what you're showing here.

A. This map represents the location of local congressional district offices. So the red dots are the location of an office maintained by a member of Congress for the purposes of receiving requests and visits from constituents.

And what's notable in this map is the areas shaded in yellow represent places where the closest congressional district office is in the district in which the constituent

does not live. So those places shaded in yellow, if they were to go to the closest congressional district office to their home, they'd be in the wrong district and, indeed, they would not be able to receive representation from that member of Congress.

So this is an illustration of some of the practical costs of gerrymandering. For these folks shaded in yellow, in a very tangible way, their ability to access their member of Congress is compromised by the nature of the map.

Q. How does that affect the quality of their representation?

A. Well, what political science research suggests is that in-person visits to a congressional office are more influential than other kinds of contacts, more influential than calls or e-mails or letters.

Part of the premise is that in-person contact can't be faked, it can't be, you know, manipulated; whereas, I might be able to get a mass e-mail sent that doesn't reflect personal opinion. Anybody who actually shows up to an office to speak to a congressional staff has to have, obviously, gone to personal effort for it.

And so, you know, what you see for more than 3 million Ohioans represented in these yellow-shaded areas is a disjuncture, a hurdle between them and access to their member of Congress. And, you know, at sort of a fundamental level, you know, going all the way back to the *Federalist Papers*, you

know, this relationship between -- between members of Congress and their constituents. Madison referred to it as a relationship that should be familiar, affectionate and dependent, that the member should be familiar with their constituents, have some affection toward them and be dependent upon them. This map illustrates, you know, a disconnect in that -- in that relationship, in that these folks have to go to greater effort to present themselves to their member of Congress to be heard.

Q. Dr. Niven, you've just discussed four areas on the map. How can you draw a conclusion about the entire map from these four areas?

A. Well, first of all, of course, we discussed the map in its entirety with respect to census tracts and we discussed the map in its entirety with respect to congressional district offices. But with regard to your question specifically, you can't separate out the map from its constituent pieces in understanding it, and so we talked about several districts, actually, 1 and 2, 3, 12 and 15, District 9, Districts 11, 13, 14 and 16. We actually just talked about the majority of the districts in Ohio. More than that, you can't really separate them out from -- from the rest of the state. So the examples that we've illustrated are indicative of the state of the map, the health of the map. You know, it is this fundamental -- if there is, you know, a -- an imbalance in districts, then

there's an imbalance in the map as a whole.

Q. What, if any, conclusion did you draw as to the intention of the map drawers from your work?

A. My conclusion is that partisan people, partisan staff imposed partisan splits, and in the process they gained a partisan advantage. My conclusion is that they did that for partisan reasons. That when you look at the entirety of the map, there is an imbalance in the treatment of Democrats and Republicans. When you look at the entirety of the map, there is a relentless splitting of communities. When you look at the map as a whole, you see a commitment to the strategic splitting and, indeed, the partisan splitting of Ohioans.

And given that pattern and its statistical significance, I conclude that the Republican mapmakers drew this map for their political advantage and at a cost to Democratic voters' representation.

MS. LEVENSON: Thank you very much, Dr. Niven. I have no more questions for you.

JUDGE BLACK: Very well. It's 10:45. We are going to break for 15 minutes, until a couple minutes after 11:00.

Professor, during the break, do not discuss your testimony with anyone.

THE WITNESS: No.

JUDGE BLACK: Enjoy the break. The Court prepares to recess for 15 minutes.

COURTROOM DEPUTY: All rise. This court is now in recess.

(Recess taken: 10:46 AM - 11:05 AM.)

JUDGE BLACK: Thank you. Please be seated. The witness may re-take the stand.

(J. David Niven resumes the witness stand.)

JUDGE BLACK: It's is 11:05. Forgive us. There were IT issues perhaps.

The witness is on the stand and he remains under oath.

And he understands; correct?

THE WITNESS: Yes, Your Honor.

JUDGE BLACK: Cross-examination?

MR. McKNIGHT: Yes, Your Honor.

JUDGE BLACK: Brace yourself.

A couple of minutes?

MR. McKNIGHT: I hope so.

CROSS-EXAMINATION

BY MR. McKNIGHT:

Q. Good morning again, Dr. Niven. We met at your deposition in Columbus a few months ago. My name is Michael McKnight, and I'm one of the attorneys for the defendants in this case.

Dr. Niven, in addition to being an academic, I believe that you testified that you were also a political speech writer; is that right?

A. Yes.
Q. Okay. And you worked as a speech writer for several prominent Ohio Democrats, including Governor Ted Strickland and Mayor Michael Coleman of Columbus; is that right?
A. Yes.
Q. All right. And you've also provided political consulting services for politicians and candidates for whom you've also written speeches; is that right?
A. I have worked for a variety of candidates and academic leaders as well.
Q. All right. And you've never provided speech writing or political consulting services to a Republican client, have you?
A. I don't know the partisanship of the academic leaders I've written for, so they might have been Republicans.
Q. Okay. But in terms of the political clients?
A. No, not in a political context.
Q. And before you became involved in this case, you didn't have any involvement with redistricting matters, did you?
A. No.
Q. And you've never advised a legislature or redistricting authority on any redistricting matters, have you?
A. No.
Q. And before you became involved in this case, you had not advised anyone else on any redistricting matters, had you?
A. I was involved in Palm Peach County, Florida, efforts to

create districts for school board elections, more at the level of what would be the consequence of switching from at-large to districts than drawing the districts; but otherwise, no, I have not been involved in the district-creation process.

Q. Okay. And when did that on occur?

A. It would have been in the early 2000s. I couldn't tell you the exact year.

Q. All right. And what was your role in that effort?

A. There was a campaign afoot to change the election process from at-large to -- to a districting system, and so I -- I offered some opinions on what effects having districts would have in the county relative to electing folks countywide.

Q. All right. And were you offering those opinions as an academic expert or in what capacity?

A. Yeah, as an academic analysis of, you know, what -- what would be the likely effects of this, you know, if this were to occur. In south Florida, this was, you know, the kinds of things that you would take to an editorial board to, you know, to offer, you know, an analysis of, you know, what would be the value of doing this.

Q. So you were advising on the communications aspect of that; is that right?

A. Right.

Q. All right. And you were also a candidate, I believe, in south Florida; is that right?

A. Yes.
Q. And you ran for the -- you were seeking the Democratic nomination for a Florida legislative seat; is that right?
A. In the statehouse, yes.
Q. Now, as an academic, you've never published any articles on redistricting or gerrymandering, have you?
A. I have not published on redistricting or gerrymandering. I've published on congressional elections and congressional representation.
Q. All right. And as an academic you have not worked with geographic information software like Maptitude, have you?
A. No, I am not a geographer. I do not personally work with that kind of software.
Q. And you had never studied communities of interest before being engaged to work on this case, had you?
A. No. I took a much more in-depth interest in communities of interest in the context of this case.
Q. And before this case, you also had not tried to identify boundaries for communities of interest in any districting plan, had you?
A. I had not.
Q. All right. And you hadn't used or studied census tracts before writing your reports in this case, had you?
A. I had not had specific need to use census tracts. I'd used a variety of census data points in understanding the makeup of

districts as a whole.
Q. All right. And before preparing your reports in this matter, you had not performed any analysis regarding the location of congressional district offices, had you?
A. No.
Q. And you had not published any articles on the provision of constituent services by members of Congress, have you?
A. Not yet.
Q. And for your reports in this case, you didn't perform any analysis of the ways in which constituents seek to contact their members of Congress, did you?
A. I did not.
Q. And it's accurate to say that the most popular means for constituents to contact their members of Congress is by e-mail or through the member's Web site, isn't it?
A. At this time, that is the most frequent form of contact.
Q. And a constituent can contact his or her member of Congress by e-mail or through the member's Web site anywhere that constituent has Internet access; isn't that right?
A. They certainly can access that anywhere they have Internet access, but, of course, it comes at a cost that -- because an e-mail could be mass-generated, you know, the value of that contact is not as high as other forms of contact.
Q. And for your reports in this case, you didn't conduct any study of whether people in Ohio had difficulty accessing their

member of Congress' district office, did you?
A. I did not study the -- the literal process of their conveying themselves to district offices. I studied the distance they would have to travel to get there.
Q. Well, and there's nothing in your report that shows that any member of Congress from the state of Ohio has not been responsive to any of his or her constituents since the 2012 plan has been in effect, is there?
A. I think the report has some materials that is strongly suggestive about differences with respect to, just as Fenno would say, the centrality of a constituent in a member's thinking and in the -- they were operating as a member of Congress. I certainly would highlight Congressman Chabot's assertion that he thanked the legislature for adding Warren County and he spoke of his love for the voters of Warren County as exactly the kind of differential that Fenno warned would happen, that not everyone in the district is created equal.
Q. All right. But neither you nor Mr. Fenno studied anything about that issue with the state of Ohio, did you?
A. No.
Q. And there's nothing in your reports comparing the locations of congressional district offices under the 2002 plan with the locations under the 2012 plan, is there?
A. No. It is a contemporaneous look at this.
Q. And as a political scientist, do you understand seniority

to be an important factor in how effective a member of Congress can be?

A. It is a factor in their -- in their legislative career, absolutely.

Q. And all other things being equal, a member of Congress who is more senior is generally more likely to be influential in the legislative process; correct?

A. Generally, that's true. Certainly it's going to matter which party they're in, but, generally, that's true.

Q. And you would agree that incumbency protection is considered a traditional redistricting factor in the field of political science?

A. I would draw the distinction within the field of political science, I think it's a traditional factor in the practical drawing of districts. It's not something necessarily that academics would weigh in on.

Q. All right. If we could pull up your first report on the screen.

MR. McKNIGHT: And for everyone that is Plaintiffs' Exhibit 524.

Q. And, Dr. Niven, I want to direct your attention to page five of that report. I believe this is a chart that we looked at earlier today.

And on the next page of your report, on page six, in discussing the chart that we looked at earlier today, you

include a sentence that states, "When the lines were redrawn in 2011, the number of split census tracts jumped by almost 59% to 332."

Do you see that?

A. Yes.

Q. And the way you calculated that 59 percent number is you just divided 332 by 209; is that right?

A. Well, you divide the difference between 332 and 209 by 209, and that's 59 percent.

Q. Okay. All right. Now, in your report you never say how many total census tracts Ohio had in either of the decades provided in your chart, did you?

A. No.

Q. I think you testified that it was around 3000; is that right?

A. Yes.

Q. Okay. And in the prior decade, the 2000 to 2009 decade, does the number 2941 census tracts sound correct?

A. Yes.

Q. And for the 2000 -- following the 2010 census, does the number 2952 sound correct?

A. Yes.

Q. Now, in your report you do not state what percentage of census tracts in Ohio were divided versus what percentage were not, do you?

A. No, I don't believe I do.
Q. Would you be surprised under the numbers we just discussed, after enactment of the 2012 plan, 88.75 percent of all census tracts in Ohio were not divided?
A. No, I wouldn't be surprised by that at all. As you'll note in the rebuttal report, the number of Republican census tracts that were divided was under ten percent. The number of Democratic census tracts that were divided was 14 point something percent, so it would make quite a lot of sense that the number of divided tracts would fall in between those two numbers.
Q. All right. And you're not aware of any evidence that census tracts were used in drawing the districts at issue in this lawsuit, are you?
A. I am not aware that they were attended to by the map drawers. I am aware that census tracts were available in the OCURD data, and so the map drawers had access to this and could have used it at any time to run a check on their work and see if they were adding to divisions beyond the previous map.
Q. Now, in your first report and in your supplemental report you provide statistics related to census tracts that were kept whole versus census tracts that were divided; is that right?
A. Yes.
Q. So if we could please turn to your rebuttal report, which is identified as Plaintiffs' Exhibit 526. And I specifically

want to direct your attention to page two of that report. And you provide a chart there on page two.

And in looking at the numbers you provide in this chart, I want to make sure I understand how you arrived at these. A census tract with a value of one would be a tract where Republicans had a hundred percent support; is that right?

A. Right. They would have had 100 percent support in whichever the applicable category, you know, the race in that particular index.

Q. And a census tract with a value of zero would be a tract where they had zero percent support; is that right?

A. Right.

Q. All right. And so if under these numbers a census tract was above .5, you considered it Republican oriented; is that right?

A. For purposes of this research, yes, I consider anything above .5 a Republican tract.

Q. And if it was below .5, you considered it Democrat oriented; is that right?

A. Yes. For the purposes of this analysis, yes.

Q. And would you agree that a district with a political index that is between .45 and .55 would be considered competitive?

A. Yes.

Q. All right. And you can't say what percentage of the census tracts that were divided between congressional districts in

Ohio are competitive under the index you use, can you?
A. I did not break it down in that fashion, no.
Q. And in response to criticisms from Dr. Thornton, you include a chart comparing the four-race index used in your original report with a broader eight-race index; is that right?
A. Yes.
Q. All right. And under the eight-race index, both the intact and split census tracts were Republican oriented, to use your terminology; correct?
A. Using my terminology, yes, but I would point to the difference between the two, which is the intact were significantly more Republican oriented than the split.
Q. And when is a tract significantly more Republican oriented? Where is that line?
A. Well, from my purposes here it's statistical significance. What I'm meaning is that this couldn't have happened by random chance. And so what's notable in this table is, regardless of which elections you're looking at, every single way you look at the data, the intact census tracts are more Republican, and the split census tracts are more Democratic relative to each other.
Q. So are you saying that there's a statistical significance between the number of .53 -- yeah .5340 and .5033?
A. Yes.
Q. Okay. Now, in your report I believe you say these numbers reflected the average support Republicans received in these

census tracts.
A. Uh-huh.
Q. Is that right?
A. Yes.
Q. And when you report the average, you're reporting a mean; is that right?
A. Yes.
Q. Okay. But you don't report a standard deviation or correlation coefficient, do you?
A. I did not include that in the report, no.
Q. And that's something that you would have included if you had reported the same statistics in an academic paper, right?
A. Yes. If this were an academic paper I would have included a lot more in the way of footnotes and statistical documentation. I was attempting, for the purposes of economy and to be understood by a wider audience, not to get too far into the weeds of statistics in the report.
Q. Now, you calculated the statistical significance using a measure known as Pearson's Product-Moment Correlation; is that right?
A. That is one of the calculations that I did. I also reran the numbers using a T-Test, and then elsewhere in the report, when I examined the difference in treatment of Democratic and Republican census tracts, I used a Chi-square measure. All of them ultimately are measures of the likelihood that a

relationship of that particular size and duration could happen by chance.

Q. And you reported the P value produced from that calculation; right?

A. Yes.

Q. And Pearson's Product-Moment Correlation also provides a correlation coefficient in addition to the P value, doesn't it?

A. Yes, it does.

Q. But you didn't include that in your report, did you?

A. No.

Q. And you would have included that in your report if you had been publishing it in the course of your academic work; right?

A. Yes.

Q. And having the correlation coefficient would allow us to determine the strength of the relationship along with its significance; is that right?

A. It would be an additional useful piece of information. I thought that these relationships were more clearly conveyed with just the straight numbers. As you said, when I continue this work and publish it, I will add in standard deviations and R-square values and correlation values.

Q. All right. Now, a Pearson's Correlation doesn't allow you to draw causal inferences, does it?

A. No.

Q. And you testified earlier today that you believe political

motives explain the differences in the splits between Republican- and Democratic-oriented census tracts in your report; is that right?
A. Yes.
Q. But in arriving at this conclusion, you only reviewed the numbers we discussed and didn't try to control for other possible explanations, did you?
A. I did go back after our lovely chat during the deposition and use what was available within the OCURD data, so I controlled for population size and the partisan effect maintained even when controlling for population size. The OCURD data does not include some of the other potential factors that one might add to an analysis.
Q. But you didn't include that in any of your reports, did you?
A. No, I did not have that opportunity. I was -- I was intrigued by the question that you and your colleague raised, so I went back and double-checked on it.
MR. McKNIGHT: Your Honors, I'd move to strike that testimony, then, because that was not properly disclosed in his report.
JUDGE BLACK: Your motion is noted.
Q. Are you aware that the Census Bureau states that census tracts can have as little as 1200 people or as many as 8,000?
A. Yes.

Q. And for your reports you didn't design a statistical study that controlled for population or geographic distinctions between census tracts, did you?
A. No.
Q. So you can't say how many of the census tract splits occurred in rural counties versus how many occurred in urban counties, can you?
A. I did not specifically calculate that. I, you know, certainly gave examples in the report of some concentrations of census tract splits in particular counties. So one could infer that -- the relatively speaking higher numbers in urban counties, but --
Q. All right. Dr. Niven, is it accurate to say that the only boundaries a census tract will not cross are those of a state or county?
A. Yes.
Q. And so if a county is not divided in the creation of a congressional district, then those census tracts within that county would be divided, right?
A. I think you may have misstated that, but if a county is not divided, those census tracts are not divided.
Q. All right. I think we're on the same page there.
In drawing the 2012 plan, the map drawers had to split large urban counties like Hamilton County, Franklin and Cuyahoga because they were too large to be included in a single

congressional district; right?
A. Yes.
Q. And you have described those three counties as Democratic oriented; is that right?
A. Yes.
Q. So let's go back to your first report, which is Plaintiffs' Exhibit 524. And I want to talk about a few things in that.
Before we do that, you obtained the information about the number of census tract splits in each county from the Census Bureau's Web site, didn't you?
A. Yes.
Q. And the Web page you used to determine the number of census tract splits for the 2012 plan is identified in a footnote on page six; is that right? If you want to turn to page six of your report, what I'm referring to is Footnote 13.
A. Yes.
Q. And you didn't include the number of census tract splits in each county in your report, did you?
A. I did not.
Q. Now, I followed the link to that Census Bureau Web page that you provided in Footnote 13, and here's what I found and you tell me if this sounds right to you.
A. Uh-huh.
Q. In Cuyahoga County, it appeared to me that there were 26 census tract splits. Does that sound about right?

A. I do not remember off the top of my head, so I'm just going to have to say I don't remember.
Q. Okay. And in Franklin County, I saw that there were 87 census tract splits.
A. That sounds about right.
Q. Okay. And in Hamilton County there were 36 census tract splits.
A. That sounds about right, though, of course, if you were to look at the previous map, you'd find that those numbers are dramatic increases from the map previously in place.
Q. Okay. But you didn't report that in your report anywhere, did you?
A. No. I went for the overall summary of the trend rather than county by county.
Q. Well, would it surprise you that in those three urban counties there were a total of 149 census tract splits?
A. No.
Q. Okay. So that's slightly less than half of the total number of census tract splits that you reported in the chart we looked at a few moments ago?
A. Certainly.
Q. All right. Now, you've testified that among Republican-oriented census tracts only 9.4 percent were split among congressional districts and that 13.8 percent of Democrat-oriented census tracts were split.

A. Right.
Q. Is that right?
A. Yes.
Q. And for your report you did not perform any study comparing the population of the Democratic-oriented census tracts that were split with the population of the Democratic-oriented census tracts that were not split, did you?
A. Not for the report.
Q. All right. And, similarly, you didn't provide any comparison of the spatial size of the census tracts that were split with the spatial sides of census tracts that were not split, did you?
A. No.
Q. All right. I want to think about some things that you said on page -- well, I guess it's section four of your first report that you entitled "Cracking Hamilton County," and that starts on page six of your first report.
A. Okay.
Q. And why don't we go to page ten first. And in this section of your report on page ten you were discussing divisions involving Hamilton County; right?
A. Yes.
Q. Now, you haven't studied the neighborhood in which this split occurred, have you?
A. The particular split that we're referring to on North Bend

Avenue is described at the bottom of page nine. It's a very Democratic neighborhood, far more so than the county as a whole.

Q. But that's the only study that you did of that neighborhood; is that right?

A. Yes. It's a study of the politics and people and why they would possibly have been subject to this -- to this split.

Q. All right. Let's turn to page 12. And I believe you list on page 12 of your report 14 neighborhoods that you say were divided between the 1st and 2nd Districts in Cincinnati; is that right?

A. Yes.

Q. Now, you do not report the population in each neighborhood that was split between each congressional district, do you?

A. No.

Q. And you also do not report the political orientation of each neighborhood, do you?

A. No.

Q. Instead, you're providing an average index for all 14 of those neighborhoods; is that right?

A. Yes.

Q. All right. And I think you identify certain African-American neighborhoods in Cincinnati that were divided between the 1st and 2nd District; right?

A. Yes.

Q. I think in your report you also write that white residents are a plurality in Cincinnati; is that right?
A. Yes.
Q. So would it also be correct to say that a majority of the residents of Cincinnati are not white?
A. Yes.
Q. Okay. And do you know what percentage of Cincinnati residents are African-American?
A. I could estimate it's around 30 percent, but I don't know exactly.
Q. All right. But whatever the Census Bureau statistics say about that would be accurate?
A. That's what I would work with, yes.
Q. All right. You do not include any information in your report showing whether any of the same neighborhoods listed on page 12 were also divided on the 2002 plan, do you?
A. I did not provide that, no.
Q. In thinking further about Hamilton County, do you know how long Congressman Chabot has represented the 1st District in Hamilton County?
A. Well, with a break, he's been there, I believe, since 1994.
Q. Okay. So there was a single term, I believe that was in 2008, in which a gentleman name Steve Driehaus won; is that right?
A. Yes.

Q. Okay. But other than that, Congressman Chabot has been there since 1994?
A. Yes.
Q. And that was under -- he was elected under a plan that was in place two plans ago?
A. Two maps ago, yes. Two maps ago, one map ago and the current map.
Q. Okay. I want to think about some of the things you said with respect to the 9th District. I think your discussion of that starts on page 14 of your report.
In discussing the 9th District, you focused on an area in Erie County called Florence Township, didn't you?
A. Yes.
Q. And under the picture of the mailbox you include the following sentence, don't you --
And let me read this to you and you can let me know if I read it correctly.
-- you say: "That Ohio's 9th Congressional district is home to most -- but not all -- residents of Florence Township is emblematic of the skewed nature of the line drawing process."
Did I read that correctly?
A. Yes.
Q. How did you determine that Florence Township was divided?
A. Census data.

Q. And, specifically, what census data?
A. It's referenced in the report. I combined the census reports on the assignment of towns to congressional districts with a, in this case, a house-by-house analysis to make sure that it was accurate. So what I wound up doing was sort of cross-referencing that with addresses that appeared to be at the boundary of the district and then using the congressional -- official congressional Web site that tells you what district a residence has been assigned to, to verify that, indeed, Florence Township was split between districts.
Q. Now, did you use that same process to determine the identity of the other townships that you identify as divided in your report?
A. For the most part, I used census data and then double-checked if there was any question about a circumstance where perhaps the boundaries were a little bit unclear.
Q. All right. And are you aware that the U.S. Census Bureau has maps on its Web site of congressional districts?
A. Yes.
Q. Okay. And have you ever looked at those?
A. I have looked at them, but I did not use them for the purposes of this analysis.
Q. And have you ever seen a map of the 9th Congressional District with Florence Township in it?
A. Yes.

Q. Okay. What map was that?
A. Again, I went to the site of the U.S. Congress, so you know, house.gov.
Q. And you're saying there's a map on there that shows Florence Township in the 9th District?
A. There's a map that shows the entire district, and then you can zoom down into particular addresses and then you can assert where those addresses are, and then you can determine, you know, what the -- what the makeup of the district is.
Q. Okay. Well, after your deposition, I wanted to get a better idea of where the various areas are that you said were divided in your report, so I went to the Census Bureau Web site and found a map of the 9th Congressional District.
MR. McKNIGHT: And if I may, Your Honor, I'd like to get a copy of that map and hand it to the witness and to the Court.
JUDGE BLACK: Very well.
MS. LEVENSON: There's an exchange of demonstratives and we didn't receive this.
MR. McKNIGHT: This isn't a demonstrative. It's being used for impeachment purposes.
MS. LEVENSON: You're demonstrating it to the Court?
MS. McKNIGHT: It's being used for impeachment purposes.
JUDGE BLACK: Counsel, do you need the Court's

assistance?

MR. McKNIGHT: Well, I guess she can note her objection.

JUDGE BLACK: What's the objection, if any?

MS. LEVENSON: Oh, objection. This isn't a demonstrative.

MR. McKNIGHT: And I'm not --

MS. LEVENSON: This hasn't been disclosed to us as a demonstrative.

MR. McKNIGHT: And I guess my response is, I'm not using it for demonstrative purposes. It was my understanding under the rules that any document that was used for impeachment purposes did not have to be disclosed.

(Judges confer privately.)

JUDGE BLACK: Very well. Objection's noted.

MR. McKNIGHT: Can I hand you all three?

JUDGE NELSON MOORE: Yes.

MR. McKNIGHT: Thank you.

JUDGE NELSON MOORE: I have an extra.

JUDGE BLACK: Be careful.

MR. McKNIGHT: Appreciate it.

If we could pull up a copy of this map on the screen.

JUDGE BLACK: I didn't hear any of that.

MR. McKNIGHT: I'm sorry. I just was saying, could we -- yeah, we've got a copy of this map on the screen -- so

that everyone else can see it.
Q. Dr. Niven, have you ever seen this map before?
A. I haven't seen this particular map, but I've seen the general gist of something very similar.
Q. Okay. And does it appear to be an accurate map of the 9th Congressional District?
A. Yes.
Q. All right. And looking at the eastern part of the district, I see where the city of Cleveland is split. Do you see that?
A. Yes.
Q. Okay. And I believe that's consistent with what is on page 15 of your report; is that right?
A. Yes.
Q. And on page 15 of your report you provide a listing of what you say are cities, townships and villages that are split between the 9th and adjoining districts; is that right?
A. Yes.
Q. Okay. All right. But then looking west from Cleveland on this map, I first came across a township called Vermilion. Do you see that?
A. I see it.
Q. Okay. And I believe that's one of the townships that is listed as being split on your map; is that right?
A. Yes.

Q. Now, on this map when I look at the legend, the boundaries of the 9th Congressional District is a double blue line; is that right.
A. Yes.
Q. And then the boundaries for MCDs --
Which townships would be an MCD; right?
A. Yes.
Q. And an MCD, for the record, is a minor civil division; is that right?
A. Yes.
Q. Okay. The boundaries for those are a dotted gray line; is that right?
A. Yes.
Q. All right. So when I look at the boundaries, for example, of the Vermilion Township, it appears to me that the Vermilion Township is located entirely within the 9th Congressional District in this map; is that right?
A. In this map it appears that way, but your map isn't fine enough to pick up on these distinctions.
Q. Okay. And what map are you saying that you used that is?
A. The official congressional map available by house.gov. I have house-by-house evidence on the Florence Township question. I don't know the proper way to introduce it, but, ultimately, part of Florence Township is in the 9th and part of it's in the 4th.

Q. Well, if you look below here, it appears that the line of the congressional district is -- of the 9th Congressional District is consistent with the line -- with the northern boundary of Florence Township; is that right?
A. I know what it appears here, but what I'm telling you is there are addresses within Florence Township that are split between these two districts. So the fact that this map shows that the district respects that boundary does not mean that it actually respects that boundary.
Q. But you have not provided a list of the houses that were split between the two -- between the 9th District and the 4th District, right?
A. No one ever asked me for that, but I'd be most happy to furnish that to you.
Q. And you didn't provide anything related to the maps that you're saying that you viewed that show that Florence Township is split, did you?
A. No, no one has asked me for that.
Q. Okay. And in your report you did not say how much of the population of each of the places on the list of places that you've got on page 15th is in the 9th District and how much is in another district, did you?
A. No.
Q. So it's impossible to know the nature of the split, isn't it?

A. The premise that I was writing to was the existence of the split, not the -- not the precise nature of it.
Q. And in your report you do not provide any comparison between the split cities, townships, and villages in the 2002 plan with the 2012 plan; right?
A. Not with respect to this particular district. In some cases the districts are so different that it wouldn't make for a meaningful comparison.
Q. All right. And in your report you reference voter confusion in the 9th District; right?
A. I reference voter confusion, yes.
Q. All right. And have you done any study of voter confusion specifically in the 9th District?
A. I have not done a study of voter confusion specifically in the 9th District. I have reviewed the political science literature and it is very, very clear that when you make splits in towns, when you make splits in neighborhoods, it's productive of confusion and it's productive of a reduction in the likelihood that constituents will know who their member of Congress is and will contact that member.
Q. Okay. But sitting here today, you can't identify any specific voter in the 9th Congressional District who was confused by the district lines?
A. No.
Q. All right. I think in the next section of your report,

which starts on page 19, you talk about what you describe as cracking and packing in Franklin County; is that right?
A. Yes.
Q. All right. And you discuss that in the context of three congressional districts, the 3rd, the 12th and the 15th; is that right?
A. Yes.
Q. Now, you first discuss the 15th district; is that right?
A. Yes.
Q. And on page 22 of your report you provide a breakdown of the Obama-McCain vote in the 15th Congressional District; right?
A. Yes.
Q. Now, in 2008, the same year that's included in this chart, the 15th District elected a Democrat Mary Jo Kilroy, didn't it?
A. Yes.
Q. But that was the first time since 1966 that that district had elected a Democrat, wasn't it?
A. Well, that's something of a reach, because that district didn't exist in 1966. You know, the boundaries have changed over time, but it had been an unusual occurrence for that area to get a Democrat, yes.
Q. But before Mary Jo Kilroy was elected, that district had been represented by a Republican as long as it did exist; is that right?

A. Yes.
Q. And then after Ms. Kilroy's only term, that district was, again, represented by a Republican, wasn't it?
A. Yes.
Q. And that person was Congressman Steve Stivers, wasn't it?
A. Yes.
Q. And he was elected to that district in 2010 under the previous map, wasn't he?
A. Yes.
Q. And he's been elected to the 15th District ever since then; is that right?
A. Yes, to a very different 15th District since then, yes.
Q. All right. Now, I believe on page 25 you discuss the 12th District; is that right?
A. Yes.
Q. All right. And you provide another 2008 Obama-McCain index; is that right?
A. Yes.
Q. But you don't mention in your report that congressman Pat Tiberi held that seat from his election in 2000 until he resigned in early 2018; is that right?
A. That is true and it's also true that I did not mention that particular fact.
Q. Now, in your direct testimony you mentioned some issues in Franklin County; is that right?

A. Yes.
Q. Now, all of your testimony about the issues in Franklin County were based upon news articles; is that right?
A. Yes.
Q. And you didn't interview any voters in Franklin County about that issue, did you?
A. No.
Q. And you didn't interview any elections officials about that issue, did you?
A. No.
Q. So you can't speak directly to what may have caused those issues in Franklin County that you testified about?
A. I can't speak directly to it, though the cause of it seems to be uncontradicted in any source I'm aware of.
Q. But that's solely news articles?
A. Solely news articles, yes.
Q. Okay. All right. I think the other district that we haven't talked about yet that you mention in this section is the 3rd District. Now, the 3rd District is currently held by Representative Joyce Beatty; is that right?
A. Yes.
Q. And she was elected for the first time in 2012 after the current redistricting plan was enacted; is that right?
A. Yes.
Q. And before representative Beatty was elected in 2012, had

an African-American candidate ever been elected to Congress from Franklin County?

A. No.

MR. McKNIGHT: So if we could please put Exhibit D3 on the screen.

Q. Now, Dr. Niven, do you recognize Exhibit D3 as an accurate copy of the congressional districts that were in place from 2002 to 2012?

A. Yes.

Q. Okay. And you're familiar with how those districts looked prior to the 2012 election cycle?

A. Yes.

Q. Okay. And under the prior congressional map, Franklin County was split into three congressional districts; is that right?

A. Yes.

Q. And the three districts it was split in were 7, 12 and 15; is that right?

A. Yes.

Q. And we've already talked about the fact that with the exception of a cycle or two, the 12th and 15th Districts have been electing Republicans to Congress for decades; is that right?

A. Well, I would, you know, dispute the characterization, because those districts didn't exist for decades. But, yes,

the area had been electing Republicans for decades.
Q. Now, do you recall who was currently elected to represent the 7th Congressional District?
A. Who is currently in the 7th? The 7th as it is now or the 7th --
Q. The 7th as it is now.
A. I believe that would be Gibbs.
Q. And that's what I had too. And is it your recollection that Congressman Gibbs has held that seat since 2012?
A. That sounds right.
Q. All right. Now, are you aware that Representative Dave Hobson and Steve Austria held the 7th District during the time that it encompassed part of Franklin County?
A. That sounds right.
Q. And both Representative Hobson and Representative Austria were Republicans, weren't they?
A. Yes.
Q. Is it your recollection that Representative Hobson was first elected in 1990?
A. That sounds right.
Q. All right. Turning to the -- one of the last sections of your report is about Summit County.
MR. McKNIGHT: And I want to zoom out again on D3 here so we can see the whole map.
Q. In your testimony earlier you criticized the splitting of

Summit County into four congressional districts; is that right?
A. Yes.
Q. Okay. And looking at Summit County under this map, it appears that Summit County was split into three districts under the prior map; is that right?
A. Yes.
Q. And you also point out that portions of the county in the current map are represented in Congress by Republicans and portions of the county are represented by Democrats; is that right?
A. That's right.
Q. But under the map in Exhibit D3, part of Summit County was in the former 17th District; is that right?
A. Yes.
Q. But that district no longer exists because Ohio lost its 17th and 18th districts following the 2010 census; is that right?
A. Well, you know, I would say that that district specifically doesn't exist. I mean, they didn't have to get rid of the 17th District just because they had two to get rid of. But, yes, they did have to redraw these lines.
Q. Well, it's fair to say Ohio lost two congressional seats after the 2010 census, right?
A. Absolutely.
Q. Okay. All right. Now, when the 17th District existed

during the last decade, do you know who represented that district?
A. I would presume that would have been Tim Ryan's district.
Q. And before Congressman Ryan represented that district, Jim Traficant represented it; is that right?
A. That sounds right.
Q. Okay. And under the map in place in the last decade, the northeastern corner of the map was in what was then known as the 14th Congressional District; is that right?
A. Yes.
Q. And a Representative Steve LaTourette represented that district, did he not?
A. Yes.
Q. And he was a Republican, wasn't he?
A. Yes.
Q. And under the -- under the map in place in the prior decade, the western half of Summit County was in what was then known as the 13th Congressional District; is that right?
A. Yes.
Q. And that district was held by Democrat Sherrod Brown and Betty Sutton; is that right?
A. Yes.
Q. And so you would agree with me that under the prior congressional map, Summit County was represented by both Democrats and Republicans in Congress?

A. Yes.
Q. Now, Dr. Niven, do you know whether any of the splits in the census tracts that we've discussed -- well, let me back up. Let me ask a different question.
Do you know whether any of the splits in the counties in the current map were made by the General Assembly at the request of Democrats?
A. I do not know if they made any splits at the request of Democrats.
Q. So you can't say whether any of the census tract splits you testified about today were due to the General Assembly's accommodation of Democrat requests for changes to the map, can you?
A. I cannot specify the precise nature and origin of each census tract split.
MR. McKNIGHT: Okay. Thank you, Dr. Niven. I have no further questions at this time.
JUDGE BLACK: Very well.
CROSS-EXAMINATION
BY MR. LEWIS:
Q. Professor Niven, good morning. We meet again.
Professor Niven, you would agree with me that Ohio's congressional plan has to split at least some census tracts, wouldn't you?
A. It's likely that it would have to split some, though Iowa

does not split any census tracts, so the number that would be required to be split is quite, quite small if one were trying to minimize splits.

Q. And have you calculated what that minimum number of splits would be?

A. I have not calculated it, but looking across other states and other examples, the number is going to be very, very small. It might not be zero, but it's certainly going to be, you know, less than 20.

Q. And would you agree with me that some splits are necessary to comply with traditional redistricting criteria?

A. There may be a small number of splits necessary, especially with regard to achieving equal population. But one of the traditional redistricting criteria is maintaining government subdivisions, and so that would be completely conducive to not splitting the census tracts.

Q. Professor Niven, are you aware that census tracts can include more than one minor civil division?

A. Yes. In a small town, a census tract might be multiple towns or townships. In a big city, in Cincinnati, a census tract might be a neighborhood. It's going to vary depending on population.

Q. So if a redistricting authority drew a congressional line to follow the boundary of a municipality, it's possible it could split a census tract in doing so; correct?

A. It would be possible to do that.
Q. I heard you testify this morning that the 2011 map shows a, quote, "relentless commitment to splitting."
Professor, is a relentless commitment to splitting consistent with a plan that does not split over 88 percent of census tracts?
A. When I say it's a relentless commitment to splitting, what I am indicating is that this was a choice, a choice that was repeated over and over and over again.
What you have seen across the nation -- and I'll give you an example. New York lost two congressional districts, and they actually reduced the number of split census tracts by 40 percent.
Ohio, in a similar circumstance, loses two congressional districts and increases the number of split census tracts by 59 percent. That is just one indicator.
You heard various testimony about the splitting of counties and the splitting of -- of towns. That is -- you know, that is far, far, beyond what would be necessary to draw districts, far beyond what would be necessary to draw compact, contiguous districts that respect political boundaries.
Q. But you've never actually drawn a congressional district plan, have you?
A. No, I've never drawn such a map.
Q. And you've never rigorously studied the minimum number of

political subdivision or other splits necessary to achieve any of the goals that you've just talked about, have you?
A. I don't know about the word "rigorous." I have looked at some other states. I don't know how many states and how long I have to look before it becomes rigorous, but, no, that has not been the thrust of my endeavors.
Q. And you don't know what was in the map drawers' minds when they drew HB 369, do you?
A. I don't know what was in their minds. I have an idea of what was in their e-mails, and based on their e-mails that I have read, it seems that they were seeking political advantage and that they were purposefully dividing areas and, indeed, disparaging certain areas as -- as unworthy -- what was the phrase they used? -- dog meat territory -- about parts of Franklin County. So I don't know what was in their minds, but if their e-mails were a representation of their thoughts, then they were evaluating people and some qualified for better class of treatment than others.
Q. And you don't know what issues the state legislature were weighing when they decided, for example, to place a district line on one street -- or to draw a district line on one street in Cincinnati versus another street, right?
A. I do not know precisely how they chose street by street. There are certainly patterns with regard to overall splits, but I do not know how they came to decide one particular house

could go in one district versus the other.
Q. And you couldn't know what the varied requests were from people in the state legislature and from others with local knowledge that the map drawers were attempting to juggle; right?
A. I do not know the full range of influences that they were -- that they were attempting to respond to.
Q. Okay. And you can't say, as you sit here today, what number of census tract splits were caused by what you consider to be a relentless commitment to splitting versus the number that were caused by the legislature attempting to satisfy traditional districting criteria; right?
A. Well, if this was all an attempt to satisfy traditional redistricting criteria, you'd say, if they did this for compact districts, then we'd have compact districts. If they did this for contiguous districts, we'd have contiguous districts. If they did this to hold political subdivisions intact, then we'd have those intact.
So as you progressively go down the list, it would seem improbable that they split all of these census tracts toward a goal they did not achieve rather than splitting these census tracts toward a goal they did achieve, which is a consistent, stable Republican advantage across the districts.
Q. Is it your contention in this case that Ohio's congressional district plan contains non-contiguous districts?

A. I believe you have to walk across water in the 9th District to stay in the district.
Q. Sir, are you aware there that are islands in Lake Erie in the 9th District?
A. I understand that there are islands, but, you know, if we bring back Mr. McKnight's map, you'll notice there's a little gap, you know, rather than including Sandusky County and keeping the district, you know, fully contiguous.
Q. You're aware there's not been a claim made in this case that the 9th District is non-contiguous, though; right?
A. I am not asserting that the continuity of the 9th District is the essence of why we're here. I'm asserting that if you were attempting to make compact districts, you wouldn't have done it this way, and so forth.
Q. And your report does not offer an analysis of the compactness of Ohio's congressional district plan, does it?
A. No.
Q. All right. Now, it's fair to say that a census tract in an urban area is going to have a smaller area and be more densely populated than a census tract in a rural area; correct?
A. Yes.
Q. So any time that a congressional district line splits an urban area, it will inevitably split more census tracts than if a rural area is split; right?
A. I think the word "inevitable" is an overstatement. If you

were to take a tiny, you know, portion of an urban area and put it into another district, you could achieve that within one census tract. So it depend. If you're going to do a slice and dice octopus shape, then, yes, it's going to split more census tracts in an urban area than in a rural area.

Q. And, in fact, if you just -- if you took a small town and a large city and you divided each in half with a completely vertical line, wouldn't you agree it's going to be more likely to split a greater number of census tracts in the urban area in that city than in a small town?

A. It's likely to.

Q. Likely to. Okay.

As a political scientist, you understand the minimization of a split of census tracts as a unit of geography to be a traditional districting criteria?

A. I don't think that political science has achieved a degree of understanding of the makeup of individual districts. As you've heard in previous testimony, the political science literature is very much focused on the big picture of characterizing the nature of state outcomes, and it's slow to adapt to the realization that we need to understand the districts within them.

So I would say to you that census tracts are a widely used tool in social science research. They have not been used as much in political science research, but I believe that will

be -- that will be changing as the research evolves and adapts to understand the makeup of districts and not just the political swing of a state.

Q. I heard you testify earlier that incumbency protection is a traditional factor considered in map drawing.

Professor, would you agree with me that efforts intended to protect an incumbent representative to Congress could have the effect of shoring up votes supportive of that incumbent?

A. Yes.

Q. So, for example, let's take Cincinnati, where you teach. In 2011, Congressional District 1 was represented by Congressman Chabot; correct?

A. Yes.

Q. And in 2011, Congressional District 2 was represented by Congressman Wenstrup; correct?

A. Yes.

Q. All right. Would you agree with me that the effect of House Bill 369 was to help protect those incumbent members of Congress?

A. It had that effect, yes.

Q. So if you're trying to distinguish between drawing a district to protect the incumbent members of Congress in Cincinnati versus so-called partisan gerrymandering, how would you draw that line?

A. Well, what the premise of your question misses is that

incumbency wasn't honored by the plan. It unnecessarily stacked three pairs of members of Congress together rather than what could have been just two pairs of members of Congress. It also weakened and potentially imperiled the political status of the dean of the Ohio congressional delegation Marcy Kaptur by putting her in a district with another Democrat. So if the intention of the map was to protect incumbents, then the map failed at that goal.

Q. But I'm referring, Professor Niven, to Congressional Districts 1 and 2. In those districts, where do you draw the line between incumbency protection and gerrymandering in Congressional Districts 1 and 2?

A. Well, again, the premise of your question that the map drawers were animated and their purpose was to protect incumbents is just not consistent with the facts. So in 1 and 2, if Steve Chabot or Brad Wenstrup had announced their retirement, would that have changed the nature of the maps in terms of the desired partisan outcome? I don't believe it would have changed it at all. And, indeed, Brad Wenstrup is a far less senior member of Congress, so, you know, under your formulation, you know, he should be less valuable, yet he was ultimately awarded the safer district.

Q. Representative Kaptur, in fact, was reelected to Congress in 2012, wasn't she?

A. She certainly was. But if your premise is that the map

drawers intended to honor incumbency and honor seniority and try and maximize the seniority of Ohio's congressional delegation, you certainly wouldn't take the senior member of the delegation and put her in a district with another member of Congress. That cuts against the very core of your premise that the map was drawn for the purposes of incumbency protection and seniority enhancement.

Q. Professor Niven, in the 11th Congressional District, I'll represent to you that there will be testimony offered that portions of Summit County were included in this district for Voting Rights Act purposes. And to begin, I'll just ask is it fair to say that the census tracts that were included in the portions of Summit County contained within Congressional District 11 were Democratic leaning?

A. Yes.

Q. And assuming the premise of my question that portions of Summit County were included Congressional District 11 for Voting Rights Act purposes, is it therefore fair to say that any census tract splits in Summit County caused by the drawing of the 11th District would be an example of census splits that were caused by factors other than partisan gerrymandering?

A. It's potentially the case that you could have split census tracts in Summit County for the purposes of creating a minority opportunity district in District 11. But, again, you have to place this action in the larger context of the split in

Cincinnati that we were just discussing reduced the concentration of minority votes in District 1.

So if the purpose of the overall map was to enhance minority representation, one would expect to see that more globally than in isolation.

Q. Again, my question, Professor Niven, was directed to the portions of Summit County contained within Congressional District 11.

Do I understand that you agree that to the extent that that district included portions of Summit County for Voting Rights Act purposes, that would be an example of census splits that were caused by reasons other than gerrymandering?

A. That could be an example of that, though again it doesn't convey much about the rest of Summit County in which there were numerous splits, you know, elsewhere in the county.

Q. And, Professor, I'd like to now refer you back to page 24 of your initial report.

Now, Professor, in your table toward the bottom of the page, if I understand your testimony on direct examination, you found it problematic that additional Republican -- that the number of Republican voters that you characterize as being added to the 15th Congressional District from the 2002 plan to the 2012 plan; correct?

A. What I was noting was really the difference in the three columns, more so than just that one particular aspect of the

district.
Q. Okay. And, Professor Niven, you don't offer an opinion in your report on the correct number of Republicans to include in Congressional District 15, do you?
A. I do not offer an opinion on the correct number of Republicans to include in District 15. What I offer an opinion on is the way that people in Franklin County were sorted and allowed to either remain in the 15th, removed from the 15th or added to the 15th, as well as the other districts, excuse me, in the county.
Q. And so fairly stated, your concern here is you just believe there are too many Republicans in the 15th district; right?
A. No, not at all. My concern here is that Democrats and Republicans are treated quite differently. It's nothing to do with the bottom line number.
I mean, if -- if a place has a lot of Republicans, it's going to elect Republicans. If it has a lot of Democrats, it's going to elect Democrats.
What we're seeing here is purposeful sorting and division, such that you treated the people who lived in the 15th differently based on their partisanship. And as you've discussed and your colleagues have discussed, you know, there's -- there's a value between the constituent's relationship and their office holder, and to the extent that you are more likely to vote Democratic, you are more likely to

be removed from that district and from your relationship from your more senior member of Congress.

Q. And in your analysis for this particular section of your report, did you consider population shifts in the greater Columbus area from 2010 to 2012?

A. I did not analyze population shifts. Did you say between 2010 and 2012?

Q. I apologize. In the -- from 2000 to 2010, the two censuses that drove the maps.

A. I certainly didn't analyze that specifically with respect to the shape of Franklin County districts. I did examine the relationship between the split census tracts and population growth across Ohio counties, and what I found is in the urban counties, the number of census tracts that were split went up regardless of whether the population grew as it did in Franklin County or population fell as it did in Hamilton County.

Q. And did you provide that analysis in either your original or your supplemental report?

A. No. That was, again, an analysis that was inspired by some of the questions from you and your colleagues.

Q. And did you produce, in connection with your report -- strike that.

MR. LEWIS: Your Honors, again, we would move to strike those responses. It's based on analysis that the witness has conceded was not included within either his

original or his supplemental report and is therefore improper under Rule 26 and under the Court's calendar order.

JUDGE BLACK: Very well. The objection motion is noted.

MR. LEWIS: Thank you.

Q. Well, now, Professor, I heard you testify in response to questions from Mr. McKnight earlier about activities that plaintiffs engaged in in the political process.

Professor, I'll represent to you that we have in the record that plaintiffs have, in this case, had private meetings with their congressional representative; lobbied their congressional representative; could attend candidate forums for debates with their representative; that they organized for change, and as was the case with Issue 1 that passed last May, were successful in driving changes even to the redistricting process itself; and, five, that they contacted their representative.

Now, Professor, you are not here to say that these plaintiffs did not have opportunities to influence their members of Congress; right?

A. I'm not here to say that they did not have opportunities to influence their members of Congress, though it's my understanding that the fact that they were plaintiffs may well have enhanced their opportunities to influence their member of Congress.

Q. And what is the mechanism by which their status as

plaintiffs in this case would have influenced their -- affected their ability to influence their member of Congress?

A. It's conceivable to me that their ability to get a response from a member of Congress' office or the likelihood that a member of Congress would contact them was influenced by their status as plaintiffs in this case.

Q. So if the contacts that I just described occurred before this lawsuit was filed, would that change your opinion?

A. That wouldn't change my opinion about what's happened subsequent to the lawsuit, but it would certainly illustrate the point that they were not without representation, but that doesn't mean that they were without any hurdles to representation either.

Q. Professor, I heard you testify about your analysis between the distance between voters' residences and their congressional districts -- and the district offices for their congressional representatives. And so I'd like to refer you to page four of the expert report, Plaintiffs' 524.

Professor Niven, here you performed an analysis and you identified census tracts in Ohio, which the closest congressional district office is located outside the district where the census tract is located; correct?

A. Yes.

Q. So if you're in the orange, the nearest congressional district is in a different district?

A. The nearest congressional district office is in a different district.

Q. Got it. And in your map and the first full paragraph that follows the map, you offer the view that the people living in those orange-highlighted areas, quote, "face significant obstacles in accessing their congressional offices"; correct?

A. Yes.

Q. Now, the only obstacle that you identify is just the physical distance from the tract to the congressional office; right?

A. Yes.

Q. Did you run a similar analysis in this case on plaintiffs' proposed remedial map?

A. No.

Q. So you can't say whether the remedial map, proposed remedial map in this case, maximizes the efficiency of the distance between census tracts and congressional district offices; right?

A. Well, I can't say that, and, prospectively, it would be a silly thing to assert because neither you nor I nor anyone else would know who the members of Congress would be under a future map. What I can tell you is that this pattern is not something that one sees in states where gerrymandering is -- is less, you know, virulent.

Q. And, Professor Niven, have you made -- in your analysis of

this distance issue, do you draw any distinction between instances where the distance between the census tract and the nearest congressional district office is relatively small or relatively large?

A. I do not draw that distinction. It is simply a comparison of access. And what this map illustrates is that there are people who are disadvantaged, that their access is, you know, reduced relative to their -- to their neighbors.

Q. Sure. So, Professor Niven, I'd like to --

MR. LEWIS: Let's highlight the area around the Cleveland area if we could on this map.

Okay. So, Professor Niven, if I live in one of these orange-shaded areas in Cleveland, how far am I from my congressperson's office?

A. It's going to vary depending on precisely where you live. In some cases, the distance is not going to be terribly far. In some cases, the district is going to be quite far. The point, however, is that the closest district office would not be able to serve you. And so the fact that you live in an urban area near a zig-zagging boundary encourages this kind of relationship. Or in other parts of the state, the unwielding nature of, for example, the 12th District leaves hundreds of thousands of people on the eastern edge of the 12th District, you know, more than an hour away from their local district office.

Q. Now, Professor Niven, Ohio, from the 2002 plan to the 2012 plan, the state lost two congressional districts; right?
A. Yes.
Q. And the state didn't change in geography, did it?
A. It certainly didn't. The shape of Ohio did not change.
Q. Okay. So isn't it true that the districts then had to grow larger in geography?
A. Yes.
Q. And isn't it true that there are significant portions of Ohio that are very sparsely populated?
A. Yes.
Q. So in those districts you might very well have people that are just, due to the vagaries of geography, located quite a distance from their congressional representative; right?
A. That may be the case, but you'll notice in relatively sparsely populated districts like District 6 where there's a certain coherence to the district relative to some of its -- you know, to some of these other districts, where there aren't really very many who are afflicted by not having access to the local district office because of the nature of the district. Whereas by contrast, you know, an absurd-shaped district like 12, the majority of residents of District 12, the local congressional district office closest to their home was in the wrong district.
Q. Okay. Now, Professor, would you agree with me that if the

distance from the correct congressional representative's office to the neighboring one, if that distance is not very great -- for example, in the Cleveland area, as you indicated -- doesn't that make the obstacle in accessing congressional offices a good deal less?

A. What it's talking about is differential treatment, number one. Number two, we can go out right now in Cincinnati and there are people that you can see highlighted on the eastern edge of the second district who could hop on a city bus and be at Steve Chabot's congressional district office in a matter of minutes, and it would be the wrong congressional district, and their trip to Congressman Wenstrup's office is going to be a great deal more challenging.

So what this map illustrates is differential access. It is not an assertion that these folks so afflicted could never be represented or could never be heard. It's a representation that this has been made harder for more than 3 million Ohioans.

Q. Okay. And when you use the term "3 million Ohioans," that -- the calculation of 3 million as the number of people affected by this alleged concern, that also does not appear in your report, does it?

A. No. That analysis continued after I finished the report.

MR. LEWIS: Okay. And, Your Honors, we would move to strike the reference to 3 million voters. Again, that was not disclosed pursuant to Rule 26 and the Court's calendar order.

JUDGE BLACK: Noted.

Q. Now, Professor, these exact concerns that we've discussed about differential access, it's possible that the concerns you've noted exist in plaintiffs' remedial map, isn't it?

A. Again, the premise of your question would assume that every member of Congress would remain in office and that every office would remain in the same place. So is it possible that this could develop? Yes. But based on my analysis, it would be far less likely when you have districts that divide fewer counties and municipalities and when you have districts that have a greater degree of compactness.

MR. LEWIS: Thank you, Professor Niven. I have nothing further.

JUDGE BLACK: Very well. Redirect, if any?

MS. LEVENSON: Briefly. Thank you.

REDIRECT EXAMINATION

BY MS. LEVENSON:

Q. Hi, again, Dr. Niven. Is there literature supporting the view that in-person contacts with a Congressperson is more impactful than e-mails, letters and calls?

A. Yes. There was a study done that focused on congressional staff members, and asked of them how influential is it on the -- on the office, on the member of Congress when a constituent contacts them. And they included various ways to do that -- by e-mail, by letter, by phone and an in-person

visit -- and the research found, without question, the staffers considered an in-person visit to be more influential than other forms of contact.

And the obvious premise why that would be is that, you know, an e-mail can be duplicated and, you know, it can be sent without necessarily reflecting the sender's commitment to an issue. But an in-person visit is a personal act and conveys quite a lot more about a person's opinions or needs, as the case may be. So the research is very clear that this is a significant avenue for folks to be heard.

Q. On cross, Mr. McKnight night provided some information that showed that many splits occur in large urban areas, such as Cuyahoga, Franklin and Hamilton Counties. Does that surprise you?

A. No. The splits were concentrated in places where Democrats needed to be surgically divided and removed for partisan purposes. So we saw concentrations of splits in places, many of which we talked about today, like the 1st District in Hamilton County and Franklin County and Summit County, because to leave the Democrats in their natural state, to leave them as they have chosen to live, would be productive of Democratic districts. So without attempting to divide them into pieces, you would -- you would see a political outcome that reflected their preferences.

Q. We also received some information from counsel that

Republican candidates may have won in previous elections in predecessor versions of their districts. Does that change the fact that the new map changed the partisan composition of the district in ways that made those districts more favorable for Republicans?

A. It doesn't really tell us very much at all, because what we see in the transition from the previous map to the current map was the enhancement of districts that Republicans had held previously but were -- were slipping and in danger of losing, and in some cases, as in the 15th District, had in fact lost.

So what's significant is the transformation of these districts from the old map to the new map, in which case every district in which, you know, the Democrats held a small, you know, small lean favorability was transformed into something safely Republican.

Q. You were shown a map, and you may still have yours in front of you. Noting that the colorful sections of the map are shown only within and not outside of District 9, do we know that those colored-in townships extend or do we not know whether they extend outside of District 9?

A. This map is not fine detailed enough to see the exact boundaries on these townships, so some of the distinctions, you know, simply get lost by virtue of -- even that blue line, you know, as we've seen here, district boundaries can be as narrow as a single house. So when you look at that blue line, that

blue line is far thicker than a single house, so you can't see the precise details of the 9th District or any of its boundary districts at this level.

Q. So what would be the impact on a voter if we can't look at a map like this and know whether you are in or out of your district?

A. It is, again, very productive of confusion as we have seen, you know, in the examples in Franklin County. You know, and one of the things that's interesting, when you go to a member of Congress' Web site, to an Ohio member of Congress' Web site, is -- and to contact them is the degree to which they have to try and help you assess whether this is actually your member of Congress or not, because they are continually contacted by folks who aren't sure what district they're in.

Q. For you to look up a home and determine whether it was in or out of a district, how long does that take?

A. It -- it's a multistep process and, you know, it takes a couple of minutes to fill out the different forms and click through, but the problem is that the average voter doesn't know where to find this information. And the more popular sources of information, when your district is split, are actually confusing and may mislead you, you know.

And certainly that's what we saw with why those several thousand voters wanted to vote in the special election in the 12th District this summer. People turn to sort of a general

understanding and what's going on in the news and what TV ads they're seeing. That's their understanding of what district they're in. They're not spending a lot of time on house.gov doing an analysis of their street.

Q. Or even a map?

A. Or even this map.

MS. LEVENSON: Thank you very much, Dr. Niven. I have no further questions.

JUDGE BLACK: Thank you.

We have reached the mid-morning break. Professor, you are welcome to step down. I don't get a chance to say it often: You're free to go. Thank you for your involvement.

(Witness excused.)

JUDGE BLACK: We're going to break for an hour until 1:30. Enjoy your break.

COURTROOM DEPUTY: All rise. This court is in recess until 1:30.

(At 12:29 PM, a luncheon recess was taken.)

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AFTERNOON SESSION

(In open court at 1:29 PM.)

JUDGE BLACK: You may be seated. Thank you.

Yes, sir.

MR. FRAM: Your Honor, the plaintiffs are now going to call our last witness: Dr. Cho. Our colleague here is going

to be handling the examination. I only make that statement at this time to say that we look forward to receiving notice this evening at 7:00 PM of the defendants' and intervenors' witnesses for tomorrow, per our agreement.

JUDGE BLACK: The Court looks forward to that as well.

MR. STRACH: Your Honor, this has moved along a lot more quickly than we thought.

JUDGE BLACK: A credit to you.

MR. STRACH: We relied on the plaintiffs' representation that they would take at least through tomorrow and maybe into Monday, so our first witness cannot be here till Monday.

JUDGE BLACK: And who is that?

MR. STRACH: Speaker Batchelder.

JUDGE BLACK: Why don't you subpoena him?

So we're going to take Friday off?

MR. STRACH: Your Honor, one thing I can say is that if we do start with Speaker Batchelder on Monday, we will be done by Friday.

JUDGE BLACK: Do you think that's good news?

MR. STRACH: I thought it might be good news if the Court --

JUDGE BLACK: Very well. Do the intervenors have a witness to call tomorrow so we don't lose a day?

MR. TUCKER: Intervenors do not, Your Honor.

JUDGE BLACK: We'll talk about it during the break. We're at least aware of it.

MR. STRACH: All right. Thank you, Your Honor.

MR. FRAM: Thank you, Your Honor.

JUDGE BLACK: Who does the plaintiff call at this time?

MR. SUBHEDAR: Good afternoon, Your Honors. My name is Nitin Subhedar. I'm from Covington and Burling, on behalf of plaintiffs. The plaintiffs would like to call their next witness, Dr. Wendy K. Tam Cho.

JUDGE WATSON: Is there anyone left at Covington or are you all here?

MR. SUBHEDAR: We have a few people left back at the office.

JUDGE BLACK: Doctor, if you'd be willing to approach, we're going to put you in the witness stand over here. If you'd be willing to pause where you are for the oath to tell the truth. Will you raise your right hand?

Do you solemnly swear or affirm that your testimony today will be the truth subject to the penalty of perjury?

THE WITNESS: I do.

JUDGE BLACK: Very well. The chair tips back. I've told every witness that, just in the spirit of full disclosure.

THE WITNESS: Okay. Thank you.

JUDGE BLACK: So why don't you get used to it.

THE WITNESS: Okay.

JUDGE BLACK: And we're going to need you close to that special federal microphone.

THE WITNESS: I got it.

JUDGE BLACK: Very well. You can begin your examination, counsel, slowly, so the court reporter can record it.

MR. SUBHEDAR: Thank you, Your Honor.

So we have prepared a binder with some of the exhibits that we'll be using during the examination. I believe the Court has been provided courtesy copies. There should be one copy on the witness stand, and we will get copies to counsel.

WENDY K. TAM CHO

a witness herein, having been previously duly sworn, testified further as follows:

DIRECT EXAMINATION

BY MR. SUBHEDAR:

Q. All right. Good afternoon, Dr. Cho. Could you please state your name for the record.

A. Yes. It's Wendy K. Tam Cho.

Q. And if you could take a look at your binder, please, and turn to tab -- the tab marked Exhibit P086. Do you recognize the document that is at that tab?

A. I do.

Q. And what is this document?

A. It's my CV.
Q. Okay. And does this document summarize your academic and professional background?
A. It does.
Q. Can you please give us a general summary of your educational background.
A. Sure. I have a bachelor's degree in political science and in applied math where my applied field was computer science. I have masters' degrees in political science and in statistics and I have a Ph.D. in political science.
Q. Okay. And from which institutions did you obtain each of those degrees?
A. All from UC Berkeley.
Q. And where are you currently employed?
A. The University of Illinois at Urbana-Champaign.
Q. And what positions do you hold at the University of Illinois?
A. I'm a full professor and I have appointments in the Department of Political Science, the Department of Statistics, the Department of Mathematics, the Department of Asian American Studies, the College of Law, and I'm a senior research scientist at the National Center for Supercomputing Applications.
Q. Okay. And do you have any affiliations with organizations at the University of Illinois?

A. I do. I'm a faculty member in the Illinois Informatics Institute, I'm affiliated with the Computational Science and Engineering Program, I'm affiliate of the CyberGIS Center for Advanced Digital and Spatial Studies, I'm affiliated with the Cline Center for Advanced Social Research, and I'm affiliated with the Program on Law, Behavior, and Social Science.

Q. Okay. Have you been inducted into any honorary societies?

A. Yes. I'm a fellow of the John Simon Guggenheim Foundation, and the Society for Political Methodology.

Q. Do you have -- well, can you tell us a little bit about what the Guggenheim Fellowship is?

A. Yeah. Those are awarded to scholars or other creative people and it's to honor -- I never remember the phrase, but it's something like exceptional past achievement and exceptional promise for future accomplishments, something like that.

Q. Okay. Now, do you have any academic appointments external to the University of Illinois?

A. I do.

Q. And what are those?

A. I am a visiting fellow with the Hoover Institution at Stanford University and I'm also a fellow at the Center for Advanced Study in the Behavioral Sciences, also at Stanford.

Q. Okay. Have you been a member of any government advisory boards, commissions or panels in the field of elections?

A. Yes. I have been on a number of panels for the National Science Foundation where we have reviewed things in the field of elections, and I was also a member of President Obama's Commission on Elections.

Q. Okay. Are you a member of any professional associations in the field of political science?

A. I am. I'm a member of the American Political Science Association, and I was also a member of their governing board like a decade ago.

Q. Okay. Have you served as an editor or an editorial board member for any publications in the area of political science?

A. Yes, I was editor of a journal called *Political Analysis*, which is the premier journal in political methodology in the field. And I've been an editorial board member for, I think, another ten or 11 scholarly journals in the field.

Q. Okay. And have you served as a reviewer for submissions to any other academic journals or publications?

A. Yeah. I've reviewed for a lot of academic publications, almost a hundred. I think it's like 97 or something like that. And those journals and other things like presses span about a dozen fields, so things like geography, economics, statistics, mathematics, operations research, high performance computing, political science.

Q. Okay. Now, you mentioned your employment at the University of Illinois. In the course of your job responsibilities there,

do you teach any classes in the field of political science?
A. I do.
Q. And what classes do you teach in the area of political science?
A. I teach classes in racial and ethnic politics, I teach classes in applied statistics, I teach classes in election law.
Q. And are those undergraduate classes or graduate classes?
A. Undergraduate.
Q. Now, do you teach any classes at the University of Illinois in the field of statistics?
A. I do.
Q. And what classes do you teach in that field?
A. I teach a probability in statics course, I teach another course on statistical modeling, I teach other courses on more advanced topics like spatial econometrics, statistical sampling, I've taught a course on Monte Carlo methods, I've taught courses on Markov chain Monte Carlo methods.
Q. Okay. On the classes that you just mentioned, are those graduate-level classes or undergraduate classes?
A. They're graduate-level classes.
Q. And do you teach any undergraduate classes in statistics as well?
A. Yes, I teach a basic data science, applied statistics type course.
Q. Okay. Now, have you conducted scholarly research in the

field of redistricting?
A. I have.
Q. And for how long, approximately, have you been involved in conducting that type of research?
A. I wrote my first paper on that probably about now 30 years ago.
Q. Okay. Now, can you please provide for us just a brief history or overview of your interest in research in that area of redistricting.
A. Yeah. It's a pretty longstanding interest, so, as I said, I wrote my first paper on it about 30 years ago, and it's something that fascinated me, basically, from that point. And so I think as I -- as I, you know, went through, got older, you know, studied other things, more statistics, more math, learned more about operations research and things like that, I always kind of brought it back to redistricting, because, I guess I always had this thing where I just kind of thought about it, and I'd learn something in statistics, and I'd think, Oh, I think I can bring that back and study redistricting with that. And maybe, like, I want to say -- was it 2019? Maybe like eight years ago the University of Illinois got a supercomputer. And at first I was just really fascinated with the idea of the supercomputer, not anything in particular, just I didn't know what it was. And probably took me about a year to get up to speed on how to use it and what it was. But then, you know,

the same idea is, you know, once I did that and I was using it, I thought, Oh, I think I can use that for redistricting.

And so I've, you know -- I'm a little bit eclectic, I think. I've studied a lot of things, and I have a lot of interest in lots of different things. And I -- and I just kind of -- I don't -- I can't help but kind of bring it together, like when I learn how to do something new on something and I kind of bring it together to all these other things that I'm interested in.

Q. Okay. Great. Have you published regarding your research in the field of redistricting?

A. I have.

Q. And can you give us an overview of the types of publications you have authored on that topic?

A. Yeah. So some of it is really just theoretical in nature. So in developing an algorithm, the statistical foundations of it, that kind of stuff, I publish in statistics journals.

I've written on algorithms for redistricting. Those are innovations and operations research, and I publish those in operations research journals.

The stuff I've done on how to use high-performance computers I published in high-performance computing journals.

Sometimes I write purely on, like, the legal aspect of it and those I've published in law reviews. Sometimes I approach it from the angle of political science, and those I publish in

political science journals.

So I've published about redistricting in lots of different fields. It just kind of depends on what angle I'm attacking it from.

Q. Okay. If you could look back at your CV, Exhibit P086, from pages two through six of that document, you appear to have listed a number of publications. Is that an accurate summary of the publications that you have authored?

A. Almost. I -- since I -- since this CV, I've had more publications, but it's -- I think there's only one more than what's on here.

Q. Okay. And are all of the publications that are listed there from pages two through six of your CV, are all of those peer reviewed?

A. The one in *Nature*, which is the third one down, is not peer reviewed. That's a one-pager that is more like commentary. And the law review pieces are -- I wouldn't call peer reviewed, but everything else is peer reviewed.

Q. Okay. Have you received any grants in connection with research that you have done in the field of redistricting?

A. I have. I have a current NSF grant to pursue high-performance computational standards for redistricting, and I've also received several grants of computing time on the Blue Waters supercomputer to study the problem.

Q. Okay. And what is the Blue Waters supercomputer, just

generally?
A. It's -- the supercomputer is funded by the National Science Foundation, and it's housed at the University of -- of Illinois.
Q. Okay. So you mentioned a moment ago, I think, that there may have been one article that you have published that is not on the copy -- on the exhibit P086, the CV that you had in the binder there with you.
Do you have a later version of your CV that you have in your possession?
A. Not at the moment, but I gave it to you guys -- I forgot -- earlier this week or last week or something.
Q. Okay. And other than that one article that you mentioned is not listed on the previous version of your CV, which is P086, are there any other things missing from that version of the CV?
A. It's -- it's also missing my other fellowship appointment at Stanford, the one at the Center for Advanced Study.
Q. Okay. Now, have you ever served as an expert witness in a case involving redistributing prior to this case?
A. I have.
Q. And what case or cases were those?
A. It was the state and federal case in the state of Pennsylvania.
Q. Okay. And what's the issue being litigated in those cases?

A. Whether the Pennsylvania map was a partisan gerrymander.
Q. And do you recall which political party was in control of the state legislature in Pennsylvania when the map that was challenged in those cases was enacted?
A. It was the Republican party.
Q. Okay. And were you retained in the Pennsylvania cases by the plaintiffs challenging the map or by the defendant legislature?
A. By the defendant legislature.
Q. Okay. And did you testify at trial in both of those Pennsylvania cases.
A. Only in the state case.
Q. Okay. And do you recall whether the Court in the state case in Pennsylvania qualified you as an expert?
A. They did.
Q. Okay. So, now, you testified for the party -- the Republican draft -- I'm sorry, the Republican legislature in the Pennsylvania case, the party that was defending the enacted map, and in this case you're testifying on behalf of the plaintiffs. Do you view that as inconsistent?
A. Not in my mind. I think a lot of people think that's a little bit weird, because one time you're working for one party and another time you're working for the other party, but in my mind I'm not working for a party. I mean, I understand a certain interest has retained me, but, to me, it's always been

about science and the process, and I really think, and I think you can see through my work, that I've spent a lot of time thinking about how science and advances can improve this aspect of democracy. And that's what's important to me, that there is sound science going on here, regardless of, you know, the actual outcome in one case or another. To me, what's important is the outcome is based on what I consider sound science and not just something that is said that isn't sound.

Q. Okay.

MR. SUBHEDAR: So, Your Honors, at this time we'd like to move into evidence Plaintiffs' Exhibit P086, which is Dr. Cho's CV.

JUDGE BLACK: Any objection?

MR. TUCKER: No, Your Honor.

JUDGE BLACK: It's admitted.

(Plaintiffs' Exhibit 86 was admitted.)

MR. SUBHEDAR: At this time we would also like to proffer Dr. Cho as an expert in political science, including political geography and the analysis of redistricting through the use of simulations in statistics including applied statistics, statistical modeling and sampling from unknown distributions in operations research including the design of algorithms and in high-performance computing.

JUDGE BLACK: There's a *Daubert* motion, but there were no objections to qualifications; is that an accurate

characterization of the intervenors' position?

MR. TUCKER: That is, Your Honor.

JUDGE BLACK: The Court deems the doctor an expert. Congratulations.

THE WITNESS: Thank you.

Q. Okay. Dr. Cho, if you could please turn to the tab in your binder with the label Exhibit 087. Do you recognize this document?

A. I do.

Q. And what is this document?

A. This is my initial report for this case.

Q. Okay. On what date did you first serve your initial expert report?

A. I believe it was October 5th.

Q. Okay. And why is the date on this particular document we're looking at October 18?

A. This one is the errata report, and I had fixed a couple things from the initial report.

Q. Okay. Between the initial report you served on October 5 and the errata report which is Exhibit P087, did you change any of the text in the body of the initial report?

A. No, no text was changed.

Q. So what was changed between the two versions?

A. What was changed were -- was Figure 19, 20, 21 and 22 were replaced.

Q. And why were they replaced?
A. When I created them, initially, I wrote some code to create them, and then there was some glitch and there was some weird thing that I hadn't realized that cut off part of the graph, and I didn't want it to be cut off, so I redid them and then I put them in.
Q. Okay. So if I refer to this document as your initial expert report in the remainder of my questioning, will you understand that I'm referring to the errata version of the report that's before you?
A. Yes.
Q. Okay. Now please turn to the tab of your binder labeled Exhibit P088.
A. Okay.
Q. Okay. Do you recognize this document?
A. I do.
Q. And what is this document?
A. It's my rebuttal report.
Q. Okay. And now please turn to the tab in your binder with the label Exhibit P426.
A. Okay.
Q. Do you recognize this document?
A. Yes, it's my supplemental report.
MR. SUBHEDAR: Okay. Great.
Your Honors, at this time I would like to move into

evidence Plaintiffs' Exhibit P086 -- I'm sorry, P087, which is the initial report; P088, which is the rebuttal report; and P426, which is the supplemental report.

MR. TUCKER: No objection, Your Honor.

JUDGE BLACK: They're admitted.

(Plaintiffs' Exhibits 87, 88 and 426 were admitted.)

Q. Okay. Dr. Cho, can you please describe in general terms the work that you did in this case.

A. Yes. So my work in this case was to analyze the current map and look at its partisan characteristics. So what I did to do that was I wrote a computer algorithm, and the purpose of that algorithm was to explore what happens when, if you have the map of Ohio and you have the people that are in Ohio and its voters, what happens if you draw electoral maps with a non-partisan process.

So, in other words, there are no political actors, there's no partisan data, and you use only the legal criteria that are -- that need to be met for a -- for a map and you use only the neutral traditional districting principles, what kind of maps emerge from such a process.

And so what I did was I wrote an algorithm to do that, and the algorithm, since we're drawing maps with a computer, I've gotten rid of all the political actors, I don't feed the computer any partisan data, so there's no partisan data, and I include the legal and the neutral traditional districting

principles into that algorithm. And so the computer draws maps in this way, and I think of these as non-partisan maps, because there are no political actors and no partisan data.

So I draw maps, and I draw not just a map or I create maps, but the computer creates millions of these maps. And the reason I do millions of them is because what I'm trying to do is, I'm trying to understand what would be a typical map that would emerge from a non-partisan process. I think that might be a little bit hard to understand. I don't know if it is or not. But I think it's a little bit easier to understand why I've done it that way if you think of a -- you know, how this is done in other contexts.

So sometimes when I'm explaining it to people I say, Let's say you're tossing a coin a thousand times. So you toss a coin a thousand times and you count out how many of the tosses turn up heads. Right? So maybe you do it and you get 582 heads. Right? And so you go, okay, 582 heads out of a thousand. And you, you know, you record that. Right? And then you do it again, toss the coin a thousand times. And the second time maybe you'll get 602 and then you record that. Right?

But to understand what would be typical number of heads from a thousand tosses, you have to do it over and over and over and over again. Right? And once you've done it a lot, a lot of times, then you can see that maybe 582 heads occurred and you can put a number on it. It occurred this many times.

Right? And then 602 occurred this many times. And you can count them up.

And then you can also see that, for instance, 500-some heads outs of a thousand is a pretty common outcome when you do this with a fair coin. And you can also see something like, if you got 950 heads out of a thousand, that could also happen from a completely fair coin. But you'll realize that that doesn't happen that often. In fact, it's actually very rare. And so the idea is, you know, if you -- if you do this and you look at all the outcomes and you can say, Oh, this is a typical outcome versus an atypical outcome.

So with the coin tosses, a thousand heads, you would realize that, for instance, you know, 482 heads, for instance, would be pretty common. It's a typical outcome. It shouldn't be super surprising to you. It shouldn't make you think that the coin wasn't fair. Right?

But let's say if you got no heads, if you tossed it a thousand times and it was always tails, then you'd think, That didn't -- you know, it might not even happen at all depending on how many times you did it; or if it happened, it wouldn't happen very often, and that would be a surprising outcome if it was actually a fair coin. Right?

The same thing with like a thousand heads. You toss it, you get a thousand heads. It could certainly happen with a fair coin, but it would be an atypical outcome.

So I'm doing basically the same thing with the computer and the map drawing. I'm taking this non-partisan process and I'm drawing maps, a lot of them, over and over and over again via the same process, and trying to see, okay, once I draw a map with this non-partisan process, what's a typical seat outcome? How many seats do the Republicans get, how many seats do the Democrats get? Right?

Then I do it again, no partisan data, no political actors. How many seats do they get? And I do it millions of times. Sometimes billions of times. And I count them up, and then I can see what's common. Is eight common? Is nine common? Is ten common? And then you can take the current map and, like, the current map is 12-4. Then you can say, Okay, does that seem like it's a typical outcome from a non-partisan process?

So that's what I'm doing and that's why I'm doing it. I'm trying to understand the current map in that context.

Q. Are you familiar the term "distribution"?

A. I am.

Q. And what is a distribution as that term is used in statistics?

A. So a distribution is what I just tried to explain. It's this -- so if you do the thousand heads, you know, you get this distribution. It's going to look, you know, like a bell curve, like that, (indicating) and basically it shows you, you know, the things that are high or the things that are common and the

things that are low or the things that are uncommon.

You know, you can think of it as a histogram. It's just showing you the distribution. Like this is how the different outcomes are distributed.

Q. Okay. Now, in order to do the analysis that you did, is there any way to look solely at the enacted map, without reference to anything else, to determine whether that map had some partisan gerrymandering in it?

A. No. So, as I said, 12-4, I don't know if it's a typical outcome or not. Right? Given Ohio, given where the people in Ohio live, maybe there's some reason attached to where they live that would compel a 12-4 outcome, even with a non-partisan process. So, for instance, let's say the Democrats lived in the four corners of the state and they didn't live anywhere else, really, that they were mostly concentrated there, because we draw districts, they'd have to have their districts in those -- those areas.

And then maybe because they live in that kind of pattern in the state of Ohio, that naturally because -- you know, we're not going to draw a map that goes all the way up the state or, you know, all the way across the bottom, or, you know, something that we would think is kind of a funny shape or -- you know, because we're trying to keep cities together or we're trying to keep counties together, and you also wouldn't do that and be able to -- to, you know, create more seats for the

Democrats. There could be all sorts of reasons why that kind of map would emerge from a process that's non-partisan. And just us looking at the map or just hearing that it's 12-4 doesn't tell you if that's a typical outcome, an atypical outcome. You know, this gives you no information on that.

Q. Okay. So are you familiar with the concept or the phrase "political geography"?

A. I am.

Q. And what does that term mean to you?

A. So that's kind of like what I just tried to describe where the -- it's the -- it's how the Democrats and the Republicans are distributed throughout the state. So a lot of people will refer to this idea that, you know, that the Democrats tend to cluster in the cities whereas the Republicans are more spread out.

And, so, because Democrats are -- or, you know, if they are clustered in the cities, then if you're trying to keep the cities together, sometimes you do what we call pack them, like, you know, you put them all together, not because they're Democrats, per se, but because maybe you wanted to keep the city together or you wanted to keep the county together or something to that effect. So that would be, you know, like a -- like political geography. It's where they are, where they're concentrated.

Q. Okay. Now, the process you performed in this case, how

does that process help you answer the question of whether a 12-4 map, for example, was enacted due to political geography in Ohio?

A. So the current map obviously is, you know -- has to take political geography into account because it's a map. Right? It has to take the voters where they are and then create a map.

So if it's trying to keep cities together, for instance, maybe it will be keeping, you know, more Democrats together than need to be. So in the process that I engage in, I'm using the same map. Right? I'm using the Ohio map, and the people are where they are. The voters are where they are. You know, the Democrats are in the city. That's where they are in my data too. It's the Ohio map.

So when I draw my maps, if there's some constraint due to political geography, I take that into account. Right? I also try to keep the cities together, so if they're concentrated in the cities, then that constrains the non-partisan process as well.

Q. Okay. So let's talk a little bit more about your process, the process you used in this case.

Now, do you look at or did you look at all of the possible maps to find out what's typical?

A. I did not.

Q. What set of maps or what types of maps did you look at for that purpose?

A. I took what we call is a representative sample of that set.
Q. Okay. And how many maps were in your representative sample?
A. It was 3 million-something. I don't have the exact number, but I'm going to keep referring to it as 3 million or 3 million-something.
Q. Okay. Now, you just used the phrase "representative sample." What do you mean by that term "representative sample"?
A. So a representative sample, let's say you're trying to, you know, figure out the -- the height of kids in a high school and you're not going to measure everybody's height. You could take a sample of kids. So you say, you know, "I'm going to measure a smaller set than the entire set." So if you -- if you do that and you only take the height of, say, the boys' basketball team, you're probably going to be a little bit off on the average height because those kids are tall or taller, probably, than the average kid. And what you need to do is not take the sample in some biased way like that, but, instead, to take the sample in a random way such that, you know sometimes you get some short kids, sometimes you get some tall kids, sometimes you get -- you know, there's no bias in the way that you're picking the kids that will go into the sample.
Q. Okay. Now, how did you go about taking a representative sample in the work you performed in this case?

A. So this is the subject of a lot of my theoretical work on the -- on the topic. It's grounded in a theorem called the fundamental theorem of Markov chain Monte Carlo. It's not my theorem, it's a theorem, and it's the one that's the basis of what I do or what I've done. And that basically ensures that the sample is representative. That's what gets us that theoretical piece.

But it's not -- it's a theorem -- you have to figure out how to apply it. And so a lot of my work in operations research is on the development of the algorithm, also in statistics is on that idea of how you take this theorem and apply it to this field of redistricting.

So I developed or devised the idea for that algorithm with my work in those fields, and then I took all of that. And there's a lot of other work there too, like we wanted to draw a lot of maps, and so one of the things we do is, you know, we figure out how to use the supercomputer, basically, to do this. And that is also the subject of a lot of my work on the topic is -- you know, it's not redistricting, per se; it's really how to use a supercomputer to speed up algorithms, how you make things faster.

So, you know, we wrote code in C++ that runs on the supercomputer that implements this algorithm that's based on the fundamental theorem of Markov chain Monte Carlo.

Q. So this fundamental theorem of Markov chain Monte Carlo, is

that relatively new or recent theorem?
A. No.
Q. Do you know if it's been used in other contexts?
A. Yeah. Every time someone writes a Markov chain Monte Carlo it's based on the fundamental theorem of Markov chain Monte Carlo -- which I might start calling MCMC, because that's too many words.
Q. Okay. So is the use of MCMC, is that something that you're aware of as having happened elsewhere in other fields, for example?
A. Yeah, it's not an uncommon technique at all, I wouldn't say.
Q. Okay. And you mentioned the algorithm that you developed. Can you just elaborate a little bit on the relationship between the fundamental theorem of MCMC and your algorithm?
A. Umm, so the fundamental theorem of MCMC, it basically says if you create a Markov chain, what we call a Markov chain, and it has certain properties, so in this case it would be positive recurrence and irreducibility, if you have those two chains -- if you have those two properties in the chain, then you're assured that the -- you're assured that there's a unique stationary distribution that will emerge from your Markov chain. If you, in addition, have this property called aperiodicity, then you're assured that there's a limiting distribution that will exist from any start of the Markov

chain. And then the Markov chain is what we call ergodic, which means it will produce a representative sample.

So we take that idea and we devise an algorithm that has these properties in the chain, and then we implement that. There's probably a lot more going on there than I'm describing in that little few sentences, but maybe on a more intuitive level, what's going on is you -- a Markov chain is something that moves from state to state, or, you know, in this case, a map to another map, and it's a random walk. So you -- you're at some map and then there's -- you -- then in the next step you're at a different map. Right? And you arrive there in a random way. And the way that you arrive there has to be based on these properties in the Markov chain.

And if you fulfill those and then you take this random walk along these types of maps, then this produces a representative sample of -- of maps. So the Markov chain part is that -- is that moving, random walk from map to map, and then the Monte Carlo part gets you that representative sample. I don't know if that was clear at all or not.

Q. Okay. So let me ask this. So the algorithm that you developed to use in conjunction with the MCMC, have you published anywhere about that algorithm?

A. I have.

Q. Can you give me a ballpark estimate of roughly how many publications you have regarding your work on algorithms used in

concert with MCMC?
A. So I published something in a physics journal about MCMC and redistricting, like, how it would work in that context, what the challenges are, what needs to be overcome, because it actually is not very easy to do.
I published something in a statistics journal about understanding the properties of these chains when you do them in a certain way. The algorithm that I used in this case, I published in a high-performance computing outlet, and that was just about the algorithm, what it is, how it works, why it's this type of algorithm.
Q. Okay. So you mentioned a number of publications just now. Were all of those publications peer reviewed?
A. Yes.
Q. Okay. Now, you mentioned also that the algorithm you used in this case was the subject of, I think, one of your publications. If you need to refer to your CV again, could you just point out which article that is? And the CV, again, is P086.
A. Yeah, it's the second one. It's titled "A Massively Parallel Evolutionary Markov Chain Monte Carlo Algorithm for Sampling Complicated Multimodal State Spaces."
Q. Okay. And just to confirm, that publication was -- or that article was also peer reviewed; right?
A. It was peer reviewed.

Q. Okay. Thank you.

Okay. Let's talk a little bit about the code that you used in this case. Can you describe, just at a high level or general level, what is the code that was used in this case?

A. So the code that was used in this case, it's a code that my colleague Yan Liu and I developed together. It's written in C++. It has a lot of pieces in it.

I added stuff specifically for this case, you know, for the facts of this case, but a lot of the code existed before and is based on some of my other research. So, for instance, some of my work that I've written on high-performance computing is really just about how you use a supercomputer to write to be really fast, basically, to compute things very quickly. And that's not about redistricting, per se. That work we've actually used in other -- to study other things.

So, for instance, I have a bunch of publications on this topic called causal inference models, and, actually, a lot of work I've done on high-performance computing was originally done for that -- to study causal inference modeling. But since it's such a general thing, it can be imported to the redistributing context because it's really about just making algorithms faster.

A bunch of my other research on operations research is also not about redistricting, per se. It's about, you know, creating algorithms that are able to search efficiently and

effectively, not for redistributing exactly, just to do that general thing. And that's also a very general idea. But, you know, we imported that -- not quite imported that code to our redistricting code, but we took those ideas and put it in this, you know, context of redistricting.

So there are a lot of, like, you know, building blocks from my research over the years that just kind of -- you know, I took and I revised and I, you know, added on what I know about redistricting and how redistricting -- the algorithm redistricting would work, and it made it faster, it made it more efficient, made it more effective, and that's how we're able to create as many maps as we have. So it's -- I would say a lot of it is kind of more like an advanced software library than, you know, purely redistricting, per se.

Q. Okay. So just at a high level -- a moment ago you spoke about the algorithm that you wrote and just now you described the code that you wrote and used in this case.

Can you, just at a very high level -- what's the relationship between the algorithm and the code, if any?

A. The code implements the algorithm.

Q. Okay. Can you estimate approximately how long it took you to write the code that was used in this case?

A. So a lot of the code spans back more than a decade, I would say. And the ideas, I think, span back even decades, because, you know, you have an idea, it does something, you can keep --

you know, it's like a building block, as I described before. You know, you take these things, you discover how to do something, it's kind of a general how-to-do something, and you -- you do other things with it, basically.

Q. Okay. So let's turn back to your initial report, which, again, is P087, and please turn to page eight.

A. What page?

Q. Page eight. Now, on this page you have a heading towards the top that says "Guidelines for Congressional Redistricting in ohio." Can you just describe, at a high level again, what this section of your report is describing?

A. So before I was saying that I create -- I create maps via a non-partisan process. So these are the criteria that I use to create the maps in -- in this case.

Q. Okay. And how did you go about determining what to include -- which criteria to include as constraints in drawing your maps?

A. So I think I also said this before, I use the -- the require -- the things that are required by law. And in that category I put population equality, contiguity and compliance with the Voting Rights Act. But in addition to that, I added on the neutral traditional districting principles.

Q. Okay. And with regard to the neutral traditional districting principles, did you apply all traditional districting principles?

A. Well, all -- I guess you're referring to all the things that have ever been mentioned as could be traditional districting principles. I didn't do that. I applied city and county preservation, compactness. So minority districts would be, I said, a legal requirement; population equality I said would be a legal requirement. So it would just be compactness, which I would say is traditional districting principle. And then the preservation of counties and cities I would say would be traditional districting principles.

Q. Okay. How did you decide which traditional districting principles to apply if you did not apply all of the ones that have been mentioned?

A. I looked at the legislative record to see what the legislature was applying.

Q. Okay. Let's go to -- stay on page eight, and I think here in the first paragraph under the guidelines heading you do mention "contiguity." Did you implement this as a constraint on your maps?

A. Yes.

Q. Okay. You also mention here "minority districts," and I think you have a heading there, a bolded heading in the middle of the page. Can you describe what you mean by minority districts or applying that in the context of your work here?

A. So I applied that as a constraint, which means that in all of my 3 millionish simulated maps, they all have a district

that has at least 45 percent black voting age population, or BVAP, in the Cleveland area.

Q. And what is the basis for this minority districts criterion that you applied?

A. So the 45 percent number I got from the plaintiffs expert, Dr. Lisa Handley.

Q. Okay. But is there some basis in the law -- I think you said it was a legal requirement. Is there some basis that you relied upon for applying any minority district's criterion in the first place?

A. Yes. Section 2 of the Voting Rights Act.

Q. Okay. Now, how did you ensure that each map in your sample of simulated maps had a district with a BVAP of at least 45 percent?

A. I check them. There's a check. It says, if, you know, there isn't at least one district with at least 45 percent BVAP in the Cleveland area, then the map was never produced from the algorithm.

Q. Okay. And then how did you ensure that the district with 45 percent or greater BVAP was located in the Cleveland area in your sample set of maps?

A. So I also checked that. So if there is such a 45 percent BVAP district, then I check to see what county that district is in.

Q. Okay. Did you include any upper bound on the maximum BVAP

value a district could have and yet be included in your sample set?
A. I did not.
Q. Now, on page eight of your report, the same page we were on earlier, you also mention City and County Preservation. What does that refer to?
A. So county preservation refers to -- there are 88 counties in the state of Ohio, and so if the county, you know, in a particular map, if a county is kept together in a congressional district, meaning it's not split between congressional districts, then we say that county has been preserved. So this is a count of, you know, how many counties are preserved.
Q. Okay. I'd like to show you a document which has been marked as Joint Trial Exhibit J01.
MR. SUBHEDAR: Your Honors, may I approach the witness?
JUDGE BLACK: Yes. Thank you.
Q. Okay. Dr. Cho, have you seen this document, Exhibit J01, before?
A. I have.
Q. What is this document?
A. So this is the legislative record I was referring to.
Q. And did you review this document when you conducted your analysis?
A. I did.

Q. If you take a look at pages 19 and 20 of Exhibit J01, can you tell me if there is anything on these pages relating to county and city preservation that you relied upon?
A. Yes. So this is Representative Huffman talking about what they were thinking when they were creating this map. And here he's talking about how there are 88 counties in Ohio, and he's talking about how many they've preserved. And he's just saying, you know, "This is something we were doing. We were preserving counties." And he calls them communities of interest.
Q. Okay. Now, how did you go about implementing city and county preservation as a constraint in your simulations process?
A. So in my simulation process, you know, I read this and I said, Okay -- I looked at the map, and when I read the legislative record I said, Okay, the legislature apparently cared about keeping counties together. It's a neutral criterion according to the Court.
And so I noticed in the map that they -- they split 23 counties. So they didn't keep them all together. You, actually, can't keep them all together. Some counties, like Franklin County, are too big to fit in one congressional district. So some counties have to be split. They split some other counties as well. They split 23, as I mentioned. And so, to me, it appeared from the legislative record that they

were trying to do this.

And in looking at the maps, since they split 23 of them, it appeared to me that they thought that if you split only 23 or you split 23 or less, that this would be how they were thinking that this would be in compliance with -- the level of compliance they wanted to have with this traditional districting principle, they were happy with this level of compliance.

Q. Okay. And did you then take that information and somehow implement a city and county preservation constraint into your simulations process?

A. I did. So in all of my stimulated maps, I don't have any maps that split more than 23 counties. The current map also splits some counties into three districts and, you know, two counties are split into four districts. So I didn't do any more of that than the current map does.

Q. Okay. And how about city splits, splits of cities: Did you implement that constraint into your process?

A. I did. So in the current map, 96.78 percent of the cities are preserved, and in all of my simulated maps I also preserved the cities at at least 96.78 percent.

Q. Okay. So now returning to your initial expert report, Exhibit P087, page nine, you have an entry or a paragraph here with a bolded heading that says "Population Equality." What does that phrase mean?

A. So population equality basically, if all the maps have the same number of people in it, then that's perfect population equality. And if they don't have exactly the same number, then the population deviation is the difference between the different districts or the -- you know, the maximum difference between the districts.

Q. Okay. And is this notion of population equality, is it your understanding that it is a constraint of some sort on the drawing of an electoral map?

A. Yes.

Q. Do you have any information about the basis for that requirement?

A. Yes. So as I understand it, the requirement is that as nearly as is practicable, you put equal numbers of people in the different districts.

Q. Okay. And did you implement this constraint in your simulations process?

A. I did.

Q. And how did you implement it?

A. So in my sample maps I required all of my maps to have the 16 districts, such that there would never be more than a one percent deviation in population between the districts.

Q. Okay. Now, why did you set a limit of one percent population deviation instead of requiring exact population equality across the districts?

A. So in my maps the geographic unit that I use to draw the maps is the precinct, and I use the precinct because that's the lowest level of geography at which we have election data. And here in this case, what we're interested in is, you know, assessment of partisan effects. Right? So we need those election returns to assess the partisan effect. And I'm trying to assess the partisan effect.

So if I go lower than the precinct, I can't have as much assurance about the -- the partisan makeup of units that are smaller than the precinct. So that's why I use the precinct. But precincts are -- can be large and have a lot of people in them. And so if you use the precincts, then it's very, very hard, and, you know, not very likely that you can get to a zero percent deviation or perfect -- perfect population equality if you're using a unit like the precinct.

Q. So just to explore that last comment, is it possible to create a map of 16 districts in Ohio in which no precinct is split and ensure population equality across the districts?

A. I didn't explore all possibilities, but none of the ones I explored could I get to zero. Some of them were as low as .3 percent in population deviation. All of them were below one percent because that -- I set it to nothing above one percent. But some of them were lower, but I didn't get lower than .3 percent.

Q. Okay. Now, earlier you mentioned that the precinct is the

lowest level or smallest level, I think you said, at which election data is presented or available. Can you just explain what you meant by that.

A. Yeah. So we get election returns at the precinct level. So at the precinct level we know how many votes were cast for, you know, the Republican candidate and how many votes were cast for the Democratic candidate. Below that level we have no information. Like, you know, we have a secret ballot, so I don't know how any particular person voted, but in the geographical unit of a precinct, you know how the political or the partisan breakdown in that precinct is.

Q. Okay. Do you know what the level of population equality is in the current Ohio congressional map?

A. Yeah, it's almost perfect. The deviation is one person.

Q. Okay. Now, does the fact that you allowed one percent population deviation in your simulated maps affect your ability to compare the simulated maps against the enacted map?

A. No, because, as I explained, what we're trying to do here is assess partisan effect. Right? And that's -- that's best done at the precinct level.

And at the precinct level you can get pretty close to population equality even if you can't get to exact, but, you know, the important point is, for all of the maps in my simulated map set, all of them basically have what we might call a buddy map that is perfect population. But the way you

have to get to perfect population from one of my maps is to split a precinct.

So, you know, a precinct is a geographic unit and so you have to split it, you know, put some in one district and then put some in the other. So you're moving people around and so you're fine-tuning or doing these kind of microadjustments to get down to zero. And this is what, you know, I generally understand map drawers to do at the end of a redistricting process is to kind of fine-tune the population at the end.

And so, you know, you can take any one of my maps and bring them to zero by splitting precincts, and I don't split precincts, but you could, but this wouldn't affect the -- the partisan outcome or the partisan estimate of what we're trying to do in any kind of appreciable way.

So the fact there exists such a map, a buddy map for all of my maps where, you know, you don't have to split more counties to do this, because you can just change -- you can just take the precincts that are already in split counties and split those precincts. So then no more counties are split and you can go, you know, where the cities are split and just, you know, split some more or move some more over from one side to the other. So the city splits wouldn't change. You know, you can always fine-tune and not compromise any of the other traditional districting principles.

So you have such a buddy map for all of my maps that

conform with these other neutral criteria that I've already mentioned, and, you know -- but with my maps you're getting the best estimate of partisan effect, because that's where the partisan data exists.

Q. So let's assume that you were to take each of your simulated maps that were generated using a one percent population deviation criterion and do the type of fine-tuning that you just referenced to bring the deviation down to zero percent or very close to zero percent like the current map. If you did that for each of your 3 million simulated maps, would you expect any of your overall conclusions to change?

A. I would not, because we're already at one percent -- right? -- which is approximately 7,000 people. It's not exactly but it's approximately. And so this means one of the districts is, say, 3500 people too few and another district is 3500 people too many and so we have to move those 3500 people from one district to another via this process.

And you notice when we're talking about population equality we're talking about people now, not voters, per se. And so to actually change the partisan effect, the 3500 people, first of all, would have to be in some election that could be decided by 3500 people, and most elections aren't that close, so that's very unlikely that they're going to decide an election.

And then, second, as I mentioned, you're talking about people, not voters, so if you move like a house and it has, you

know, five people, probably three of them are kids and they can't vote anyway, and so you're moving people, but you're not moving voters. So probably of the 3500, you're not even moving 3500 voters, you're moving even fewer voters than people. So there's that aspect. So the election has to actually be even closer than that.

And then, you know, to actually change an election outcome, all those people or voters have to be of one party, which is also not very likely. And, I guess, all of these, you know, stars could align and it could happen, but in my opinion, and in the, you know, way I just described to you, the chances of this are slim to none.

Q. Okay. Now, is it your opinion that the Ohio legislature should have used a one percent population deviation standard rather than requiring exact population equality?

A. No.

Q. Okay. Let's look at page ten of your expert report, Exhibit P087, your initial report. And on this page you mention at the top "Compactness." Can you please explain what compactness refers to?

A. Okay. It's a little bit hard to explain, but it basically refers to shape. So, I guess, you know, no one really knows how to describe shapes. So I show you a shape and I ask you if it's ugly or not compact, we don't really know. You know, it's kind of you know it when you see it type of thing. You have to

see it first and then you can cast a judgment maybe, but then people don't even cast their judgments quite in the same way. But the idea is some shapes look better than others and we call those compact. I don't know if that was a very good description, but --

Q. Now, did you attempt to implement a compactness constraint into your simulations process?

A. I did.

Q. And how did you go about doing that?

A. So there are all sorts of measures that people have proposed over the years. I myself haven't proposed one. There's a lot of debate about whether they work or not. They all actually measure different things, different aspects of shape. So there's -- there's no generally agreed upon one, but they all measure some aspect of shape.

So one of the ones that is common is what we call an isoperimetric quotient, or, you know, it's also referred to as Polsby-Popper, the Polsby-Popper measure, and that's the one I implemented. And so what I did was I computed the Polsby-Popper measure for all of the districts in the current map, and then I saw what the average value was, and then I did that for all of my simulated maps. I, you know, took the 16 districts that were generated, I computed the Polsby-Popper measure, and then I took the average and I never let any of my simulated maps have a worst compactness in that specific sense

than the current map.
Q. Okay. Are you familiar with the concept of incumbency protection?
A. I am.
Q. And what does incumbency protection refer to, as you understand it?
A. So this is -- this is a phrase which I think has a little bit of ambiguity in it, because people use it and they mean different things by it. In the political science literature we discuss it a lot because we talk about elections and incumbents. And a lot of times when we talk about it in the political science literature we're talking about how do you keep an incumbent in office. Right? You're protecting that incumbent by making it so that incumbent can get reelected. And there's various ways that you can do that, but that's the idea in the political science literature.
The Courts have also used that term, and they call it a traditional districting principle, but when the Courts use it, they're not talking about the same type of thing. Like the Courts are not saying, "What we want is to reelect all the incumbents." What they're saying is that there can be value in incumbents being reelected, and that value is not to the incumbent, per se -- though, obviously, there's value to the incumbent. The value is to the voters. Right? That the voters can benefit when incumbents are reelected because that

can help -- that can help them.
Q. Okay. So do you have an understanding on whether incumbency protection can be a valid objective in redistricting?
A. It can. And the Courts have mentioned that it can. And when they mention that it can, the idea is, you know, this one that I just mentioned, that the point of it is for the Courts, if it's for the voters. Right? If it's for the voters, then it can be, you know, a valid traditional districting principle, whereas, you know, there -- there are other ways to use it.
So if you're using it to entrench the incumbents, that is not a valid way to do it. That is not the incumbency protection that the Court is talking about. They're not talking about entrenchment of power, but instead they're talking about it in this other way where you're helping the voters in some way.
It's about the voters, not about the incumbents, even though the word "voter" doesn't appear in that word incumbency protection. As I understand it, that would be valid, but the form where you're entrenching power is not, and you can't use it as a cover for entrenchment.
Q. Okay. Now, did you include incumbency protection as a constraint in your simulations process?
A. I did not.
Q. And why did you not include incumbency protection as a

constraint?
A. So this goes back to my reading of the legislative record.
Q. Okay. And what did you see in the legislative record that led to your decision not to include incumbency protection?
A. Just give me a second and I can find it.

So as I mentioned, you know, when I looked at the legislative record, I was trying to get a sense of what was the legislature thinking when they enacted this map. And as I mentioned before, when they were talking about communities of interest, they said, "These are like cities and counties." And then Representative Huffman went on and said, "We tried to keep the counties together. We were trying to do -- we were trying to comply with this neutral criteria," as it were. So I thought, okay, they were concerned about that, cities and counties.

And then you know, Representative Huffman goes and he talks about incumbency protection. So he mentions a lot of things, but he doesn't talk about all of them. And when he talks about them, that's what gives me an idea of what he's thinking -- right? -- of what the legislature was thinking when they implemented the map.

So some things he just says in passing and he doesn't ever talk about it again. And I think, Oh, they didn't care about that, that wasn't a thing, and they're not required to do that thing. And he just mentioned it in passing, so he didn't seem

to care. Whereas, like, the counties, he went on and on about it. And incumbency protection, he did -- you know, he had a little phrase on that or a little, you know, set of things that he said.

So I'm -- I'm looking at it, and I think it's here on page 21.

MR. TUCKER: Your Honor, I just want to lodge an objection to lack of foundation regarding Representative Huffman's state of mind or intent.

JUDGE BLACK: Very well. The objection's noted. Plaintiffs' counsel can note it as well.

A. So here on page 21 he's -- he's talking, and he says, "I would ask the members of the House of Representatives and the members of the public to keep this one statistic in mind." He says, "You know, we talked -- a year ago someone came up to me and said, 'Are we going to get rid of Kucinich's district?' And I said, 'Look, Kucinich doesn't have a district. Nobody has a district. Every two years, there's an election, and that's how it works. That's how the system works. There's nobody that owns a piece of land in Congress. People elect them."

So when I read this I thought, okay, he doesn't seem to be very intent on keeping Kucinich's district. Like he's -- he doesn't seem like he's going to be protecting Kucinich, because he says, "Look, Kucinich doesn't have a district." Because the

other person's saying, Are we going to get rid of Kucinich? And he's basically saying, "Hey, you know what? He doesn't have a district. He's got to run. He's got to win an election. This is not about us creating a Kucinich district" -- which would be, in my eyes, you know, incumbency protection of some sort, but he seems to not -- not think so, that this is something they are engaging in.

And then he goes, down in the next paragraph, and he says this map, the map that they enacted, has "two Republicans running against each other in a primary where they live, where their homes are. They have two Democrats running against each other," and then there's a Republican and a Democrat running against each other.

So the Ohio map, they had 18 districts before and now they have 16, so you have to pair some incumbents, you have to pair two of them. Right? So you have to have two pairs or four people have to get paired. And here they paired six of them. Right?

So it's for sure not maximum incumbency protection. So it's not like their top thing. Right? Because if it's their top thing, you know, why do they pair more incumbents than they need to pair? Which also, you know, gives you this idea, okay, that's not their top priority, because, you know, they paired more than they need to.

And then the next paragraph he says, after he's describing

pairing of incumbents to you, he says, "Now, that isn't necessarily the way it was intended to be. It could've been different, but that's the way it ended up."

And to me, it's like he just described pairing of incumbents, and then he says this isn't the way it was intended to be. So it's like, We weren't trying to do this. It could have been different. Maybe we did something else. It's like, This is just the way it ended up.

JUDGE BLACK: Excuse me.

MR. TUCKER: Your Honor, just a continuing objection to the lack of foundation on this testimony. Thank you.

JUDGE BLACK: Very well. Noted.

A. So, you know, when I read all of that together, him saying, you know, "Kucinich doesn't have a district," I'm not protecting Kucinich, look at me, I'm pairing, you know, three pairs of incumbents, not just two. And then he says, I didn't even intend that; it just could have been something else I just -- it's just the way it ended up. Right?

When I read that, I think, okay, you didn't really seem to -- this is not a top priority. This is not something you're trying to do, yet it ended up this way. So in my simulations I do, I try to implement this idea -- right? -- that in my simulations if the incumbents get -- you know, are separated into different districts, it happens. Right? And it can also happen that I get two pairs of this and two pairs of that, two

Republicans get paired, two Democrats, and I don't -- I don't intend that. Right? I don't -- I don't constrain my simulations to make that happen. I don't intend that to be, just as he didn't intend that to be. But I also don't prevent it from being. So it could have been different and just the way it ended up.

So the same in my maps, I don't intend it to happen, I don't make it happen, but it can happen. Right? It can happen, and sometimes it does happen; sometimes it doesn't happen. It's just the way it ends up.

Q. So let me ask you this, Dr. Cho. As part of your analysis, just taking a step back, did you intend to try to determine which criteria the state of Ohio, the legislature, intended to be applied in the course of redistricting?

A. Yes. And I did that through reading the legislative record and through looking at what they did with the current map.

Q. Okay. Do you have any knowledge of what was actually inside Representative Huffman's mind or what his intent was based on these statements?

A. I don't. I mean, I'm inferring. I didn't -- I didn't talk to him or do further research into this. But, you know, he's talking about the bill that enacted the map. He's describing what the legislature was doing and thinking and, you know, discussing what they did: We split this. We're trying to do that. There is what we did with the incumbents. And he's --

you know, he's going kind of on and on about the incumbents and why that happened as it did.

Q. Okay. Now, have you ever taken the position that simulations processes should take incumbency protection into account?

A. In general, no.

Q. Okay. Now, you testified earlier about your expert witness testimony in the state of Pennsylvania. In that case, and your testimony in that case, did you ever state an opinion or a view that simulations processes should take into account incumbency protection?

A. I did.

Q. Okay. And can you explain the basis for that opinion in that case.

A. So in -- in Pennsylvania when I was an expert for the defense, not the plaintiffs, the plaintiffs had asserted that incumbency protection was one of the criteria. And, you know, I didn't do any independent research on that. I just -- you know, I saw that they asserted that.

And that's also against their interest, I would think. So I assume that probably they had done a little bit of work on that and determined that this was something that was happening in the state of Pennsylvania.

What I did do was that I noticed that all the -- none of the plaintiffs -- none of the plaintiffs -- none of the

incumbents were paid. I said that wrong too.

What I noticed was that the incumbents were protected at the maximum level possible in the state of Pennsylvania by separating them into different districts. And I noted that that is an unusual thing to happen, not by chance, so they must have, you know, tried to do that. So in conjunction with the plaintiffs asserting that this was something they needed to take into account, and that they were, you know, separated in the map, then that to me, you know, given this kind of more -- this, like, totality of circumstances of what's going on in Pennsylvania, then that is something that the Pennsylvania legislature considered.

Q. Okay. Now returning to your simulations process in this case, the analysis you did in this case and the simulations you ran in this case, did you impose any other constraints in that simulations process in this case, other than the criteria that we've discussed so far?

A. I did not.

Q. Was there any partisan data such as past election results or voter registration data taken into account in generating your simulated maps in this case?

A. There was not.

Q. Now, in the course of enacting the challenged map, are there other factors beyond the traditional districting criteria and the legal requirements that we've discussed so far that the

legislature could have taken into account?
A. I'm sure they took into account lots of other factors.
Q. Can you give any examples of such considerations?
A. Sure. I don't know exactly what they took into account, but, you know, this is -- it's a map that they pass and it's the legislature that passes it.

At some point they have to figure out who's going to vote for it. And so sometimes when people, you know -- maybe if they don't have enough votes, there has to be some negotiation, you know, How do I get you on board, because we want to pass this. Maybe there's some negotiation there. I don't know what the negotiation is, but I'm sure that there's some going on there.

It might be somebody says, you know, I don't really like this map, but maybe if you move, you know, something over this way or move this line that way, then I'll vote for the map.

It could be something that seems very innocent like, let's say, I don't really like the map, but if you move my mother's cemetery into my district, then I'll vote for it. Right? Or it could be, If you do this in this part of the state, maybe there's some interest in, you know, a military base or something like that. And they want to divide it a certain way.

They can negotiate like that. All sorts of decisions go into this process other than, you know, just this kind of -- what I had, there's these kind of mundane, you know, things

like city splits and county splits.

Q. Now, did you include any of these additional types of considerations or negotiations that the legislature may have engaged in? Did you include any of those types of factors as constraints in your simulations process?

A. I did not.

Q. And why is that?

A. Because what I wanted to do was to understand what a typical map looks like that emerges from the state of Ohio when you have only the legal and, you know, neutral, traditional districting principles that have been articulated by the Court.

I know that there are all these other factors that go into it, but these other factors first have neither been recognized as something that has to be done or, you know, we don't know what all these other factors are. I know there are these other factors, but they're also not things that have to be done. Right?

So you know, any map, of course, will go through this kind of a, you know, path to getting passed, and there are many such paths under which that could happen. Right? So somebody wants this, somebody else wants that, it switches this, it switches that. None of these things have to happen and that path is not the only path that could have led to that map.

So, you know, in that sense, what I want to do is I want to develop this baseline -- right? -- that I know or am confident

in saying this baseline is non-partisan. Right?

And then there are these other decisions that go into it that, you know, after I have the baseline, I can assess those other decisions, you know, because the current map, then that's what provides that comparison. I know what a typical non-partisan map looks like that emerges from a non-partisan process. How does the current map compare to that set?

Q. Okay. Let's turn to page 30 of your initial report, Exhibit P087. And on that page there is a heading toward the top that says "Assessment of Partisan Effect of Current Map." Can you just explain at a general level what information you are setting forth in this section of your report?

A. So in this section of the report I've -- I have my 3 million maps, and now I'm trying to understand them. I look at the 3 million maps and I say, you know, how many seats were won by one party versus another. Now I can take the maps and I can assess the partisan effect of my maps and compare them to the current map.

Q. Okay.

JUDGE BLACK: Is this a decent breaking point?

MR. SUBHEDAR: Yes, Your Honor.

JUDGE BLACK: All right. We're going to break until 3:15. During the break the witness is advised not to discuss her testimony.

And she understands; correct?

THE WITNESS: Correct.

JUDGE BLACK: All right. Enjoy the break till 3:15.

COURTROOM DEPUTY: All rise. This court is in recess until 3:15.

(Witness temporarily excused.)

(Recess taken: 2:53 PM - 3:17 PM.)

JUDGE BLACK: You may all be seated. Thank you.

The witness can re-take the witness stand, although the Court has issues to address with the lawyers before we continue.

(Wendy K. Tam Cho resumes the witness stand.)

JUDGE BLACK: The Court has made a serious effort to make itself available for an adequate period of time to get this case tried properly. The notion that we are going to take the day off tomorrow and waste a day is wholly antithetical to what the Court intends and desires.

Some of the out-of-town people have relied upon the notion that we're going through the day Friday and have, therefore, made reservations to stay here over the weekend, which are unrefundable, and it puts them in a position where they will not have the opportunity to do anything other than stay here and sit idly.

It's 3:15. The Court is going to order the defendants and the intervenors to present a witness Friday if the plaintiffs finish. Some of your witnesses are Ohio based. Get them here.

The defense understand the Court's position or hear it at least?

MR. STRACH: We do, Your Honor. We will do our best. We take exception with it. We believe we should have the same right the plaintiffs did, to present the witnesses in the order that we would like to present them in. We think it's very unfair and prejudicial to us to have to do it that way when we relied on the plaintiffs, who were the ones asking for the time, who were going to go through Monday. We were going to actually have our witnesses here early by having them here on Monday. So we -- this is very unfair and prejudicial to us. I don't know -- our witnesses are based in Columbus, which is several hours away.

JUDGE BLACK: It's two. Less than two.

MR. STRACH: Two? I don't know if I can get them here. I can certainly make some phone calls.

JUDGE BLACK: The Court orders you to make that effort.

This is not a trial to a jury. This is to sophisticated trial judges and we understand that in the course of litigation witnesses are called out of order.

The Court is where the Court is. I don't know how much we're going to bleed into Friday in the plaintiffs' case, but by 2:00 o'clock tomorrow, if the plaintiffs have rested, you need a witness by 2:00 o'clock, and you've got 24 hours to do

that.

The intervenors want to make a record?

MR. TUCKER: No, Your Honor. We have nothing to add at this time.

JUDGE BLACK: Very well. The witness is back on the stand.

Excuse me. The distinguished plaintiffs' lawyer is standing.

MR. FRAM: Thank you, Your Honor. A small point.

One way or the other -- and we appreciate the Court's ruling. We would ask that the full day's -- full first day of defense and the intervenors' witness lineup be disclosed to us at 7:00 PM tonight. In the ordinary course, we'd get that tonight, and all this activity that they're going to have to now engage in shouldn't change that. We would request not just to hear that former Speaker Batchelder is coming up as a witness. We believe we're entitled to know the full lineup for their entire first day.

Thank you, Your Honor.

JUDGE BLACK: And the response from the defendants?

MR. STRACH: Well, I'll have no idea -- I don't know if I'll have any idea by 7:00 who will come tomorrow, but I certainly know who I would have brought on Monday. We can disclose that.

JUDGE BLACK: Well, when will you know who you're

going to call at 2:00 o'clock tomorrow if the plaintiffs have rested?

MR. STRACH: Well, Your Honor, I have to get folks on the phone. I have no idea.

(Judges confer privately.)

JUDGE BLACK: Well, we'll recess for 15 minutes and you can make a call.

COURTROOM DEPUTY: All rise. This court is in recess for 15 minutes.

(Witness temporarily excused.)

(Recess taken: 3:21 PM - 3:34 PM.)

(Wendy K. Tam Cho resumes the witness stand.)

JUDGE BLACK: Please be seated. Like a recurrent nightmare, we are back. Where do we stand on the defendants' contact of witnesses?

MR. STRACH: Thank you, Your Honor. So I have done the best I could. I was not able to get ahold of Speaker Batchelder.

JUDGE BLACK: You did or did not?

MR. STRACH: I did not, could not reach him. I was able to reach Troy Judy, who is one of our witnesses. He will be at home with a newborn baby all day tomorrow, so he is unavailable. I hope that is okay with the Court that he do that.

I was able to get ahold of Ray DiRossi, who was also going

to be a witness on Monday. He has some significant responsibilities in his job in the state Senate. However, he's going to make himself available tomorrow notwithstanding the significant hardship that it will impose upon him.

JUDGE BLACK: Well, that's a credit to him and a credit to you. Thank you.

MR. STRACH: Thank you.

JUDGE BLACK: Are you ready to proceed with the continued direct examination of the witness?

MR. SUBHEDAR: Yes, Your Honor.

JUDGE BLACK: The witness remains under oath.

And she understands; yes?

THE WITNESS: Yes, sir.

JUDGE BLACK: Very well. You may recommence.

MR. SUBHEDAR: Thank you.

Q. So, Dr. Cho, before the break, we had turned to page 30 of your initial report, which, again, is Exhibit P087. And let me direct your attention now to -- well, let me ask this question first.

So you mentioned that you performed some analysis of the partisan effect of the existing map against your simulated maps. Did you analyze this partisan effect using just a single metric?

A. No, I presented a number of different metrics.

Q. Okay. And why did you use several metrics instead of just

one?
A. Because partisan unfairness is a multidimensional concept. It can take on lots of different forms. You can be unfair on one dimension and be fair on another. You can be unfair on all dimensions. You can be unfair on some subset of dimensions. So I was trying to capture a more, you know, holistic picture of the unfairness.
Q. Okay. And can you just give us sort of a, again, just a high-level introductory overview of which metrics you used in your analysis in your initial report to analyze the partisan effect.
A. So the metrics can generally fall in two categories. One is competitiveness or basically responsiveness to voter behavior. So the idea there is, you know, when a district is competitive or responsive to voter behavior, then when the voters change how they behave, what happens with the elected officials is responsive. It also changes. It's not hard to change who is in office when the voters want to do that.
The other concept is biasedness, which basically is a skew toward one party versus the other party.
Q. Okay. So now on page 33 of your initial report, you have included a figure here, Figure 19. Can you please explain what this figure is depicting.
A. So earlier I had described that I wanted to look at the effect of a non-partisan process, and this is a histogram and

it's a summary of the seat split that occurs in my 3 million maps. So here, like, for instance, you can see along the X axis, or the bottom, that shows you the number of seats that would be expected to be won by the Republican party. And on the Y axis it shows you how often each outcome occurs. So if you look at the bar above number 8 -- so of my 3 million maps, that bar reaches up to about, I would say, 1.3 million. So in 1.3 million of my 3 million maps, I would expect that the seat outcome would be 8-8.

For nine seats it's a little bit lower but still pretty high. So that bar's a little bit lower. And that, I would say, is about 1.2 million, roughly. So in about 1.2 million of my 3 million maps there was a 9-7 split in seats.

There were -- I would say about 250,000 of my 3 million maps produced a ten-6 split. There are also cases here of six and 11 Republican seats, but those occurred so infrequently -- there actually is like a tiny little bar there, but they occurred so infrequently it looks like it's not there and it is there. And I mention that in the text, that there are cases of six seats and 11 seats, but they're really infrequent.

And then over to the right of that is 12 seats, which is the outcome from the current map.

Q. Okay. And so in performing the analysis that you depicted in this Figure 19, you were mentioning that you were evaluating your simulated maps and trying to assess how many seats the

Republicans would win in each of those maps.

What election data or election returns did you use when you did this analysis?

A. So for this analysis there in the upper left it says "2008-2010 Data." So these were from election returns in 2008 and 2010, which would be the elections right before the drawing of the map, and it would have been data that the map drawers would have had, the most recent data they would have had on elections in Ohio.

Q. Okay. Now, is this the only analysis of this type that you performed where you compared the estimated seat share of the current map versus the simulated maps?

A. No. So I did in my supplemental report -- one second.

Q. So let me -- before you go further, let me just direct you to Figure 1 from page three of your supplemental report. Your supplemental report is P426, and it's in your binder as well.

A. Okay. So in Figure 1 what we're looking at is I did the same analysis using data that was available after the redistricting. So in the middle figure it's data from the 2012-2014 cycle of elections. And then in the figure on the right, I use data from the most recent election, which is 2018. And so in each of these there -- you know, I have the same histogram. So the one on the left is the exact same thing you just saw.

And then the one in the middle is a little later, and the

one on the right is the most recent data. And so one of the things I was looking at is, you know, is this an effect that, you know, endures over time? Is there something changing over time? Is it something that changes with different data sets?

And I'm noticing that -- I don't have a red bar on the middle one, but that red bar should be at 12 seats. I'm not sure why I forgot that.

But in each of the figures, the current map produces 12 seats, and the histogram shows you the distribution of the seats from my simulated maps from the process I've described earlier today.

Q. Okay. And so in the middle panel of this Figure 1 from your supplemental report, what was the most common outcome in terms of Republican seats in your simulation set when you used the 2012-2014 election returns?

A. It's nine seats. So when we go a little bit further into the decade, it does change a little bit. So now nine is the most common, and eight becomes less common. I wouldn't say uncommon, but it becomes less common. And then by 2018 it looks like nine is pretty clearly the most common with, you know, eight and ten occurring almost at the same rate, but at, I would say, you know, considerably less than nine.

Q. Okay. So considering the results from the three sets of election data that you ran as depicted in Figure 1, were you able to reach any conclusions about the typical number of

Republican seats across the simulated maps?
A. Yeah. The typical number across my simulated maps seems to be either eight or nine, with nine being a little bit more favored later in the decade.
Q. Okay. And are you able to draw any conclusions about how the actual map, the one that has 12 Republican seats, compares to your simulation set?
A. So I mentioned earlier I wanted to see what is a typical outcome from a non-partisan process, and that's what I'm showing you with the histograms there. And because 12 is out on the right, that would indicate to me that 12 is not a very typical outcome.

It might be, you know, you could go back to what I was saying about the tossing of the coins. You know, 500 out of a thousand would be quite common. 999 out of a thousand would be very uncommon. So that's the same idea here is it's off to the right of where you see all the typical outcomes.
Q. Now, earlier you said that one of the metrics you looked at was competitiveness. What do you mean by competitiveness?
A. So competitiveness can be seen in different ways. I kind of took a few different cuts at this.

I looked at how many of the seats in my 16 seats in each map were within a ten percent margin of victory. So that means the end result had Republicans and Democrats in that 45-55 range. That's a ten percent margin of victory.

I also looked at a five percent margin of victory, which would be even more competitive.

And I also looked at which way those competitive seats lean, because if they all lean toward one party, that actually is not that fair either. So I looked at how many of them lean toward the Republicans, how many of them lean toward the Democrats. And I did that also with the five and ten percent margin of victory.

And then I took that concept that, you know, districts can be competitive and we want them to lean equally one way, you know, roughly half toward Republicans, half toward the Democrats. And I subsume that into one number, which is this equation on page 36. So that subsumes both of those ideas into one number, and that's what I'm plotting in Figure 23. So that's the looking at the competitiveness of the map --

Q. Okay.

A. -- of my simulated maps.

Q. Okay. Sorry.

So let's break that down a little bit. But before we do that, I think you said you ran analyses at both five percent margin of victory and ten percent margin of victory. How did you choose those two numbers, five percent and ten percent?

A. They're kind of general rules of thumb we use in political science. I think ten percent is pretty common. We say, you know, if the election comes in and it's between 45 and 55, then

we say, "Oh, that's, you know, reasonably competitive." There's no magic number there. You know, if it comes in 45.5 to whatever, that's also, you know, basically the same thing. So it's just a rule of thumb.

Q. And are those percentages or thresholds, have they been used in political science?

A. Yeah, I'd say so. People talk about that. They just say this is competitive; this isn't competitive. Usually if you're outside 40-60, that's kind of the rule of thumb as in you're not competitive, it's not a competitive election. But 45 to 55 range is generally regarded as competitive.

Q. Okay. So now let's go to Figure 20 on page 34 of your initial expert report, P087.

Can you please explain what is depicted in this figure.

A. So this is a histogram like the last one we looked at.

And the same thing. Seats along the bottom on the left shows you how often each thing happens. So here the bar above 9 looks like it's the most common, a little more than 1.2 million. So a little bit more than 1.2 million of my maps had nine seats that were in that ten percent margin of victory.

Q. Okay. Then how about on the right side of this Figure 20? What's shown there?

A. The same thing, except I'm using a five percent margin of victory.

Q. Okay. And in the analyses that are presented in the

histograms here, what election returns did you use to evaluate this in your simulated maps?

A. Still the 2008-2010 data.

Q. Okay. So now let's turn to Figure 2 on page four of your supplemental expert report. That's P426. And can you please explain what you have presented here in this figure.

A. So, again, the figure we just looked at that was on the left is exactly the same as this figure on the left. That's for 2008-2010 data. And then I did it again for 2012-2014 and then again with the 2018 election returns.

So the same thing. I'm counting up the number of seats in each of my simulated maps that falls within that 45-55 competitiveness range.

Q. Okay. And why did you do this analysis that's presented here in Figure 2 with the three different sets of election returns?

A. The same thing as before. I'm trying to see if the effect changes over time or if there's an enduring effect from the map that, you know, shows up over and over again, you know, across the entire decade.

Q. Okay. Now let's go back to your initial report, P087, and let's look at pages 34 and 35. Let's start on 34.

Here you have a figure, a Figure 20, and I'd like you to please explain what you are depicting here.

A. I just explained that one, didn't I?

Q. Oh, I'm sorry. I'm sorry. My mistake.

Let's look at page 35. My apologies. And there's a figure here, which is Figure 21. And can you please explain what you're depicting here.

A. So here, instead of counting up the total number of competitive seats, I count up the number of competitive seats that fall for each party. So in other words, you know, who's on top, which party has more than 50, in between that 45 and 55 range.

And so the one on the left shows how many of those competitive seats lean toward the Republicans, and on the -- on the right it shows how many of those competitive seats lean toward the Democrats.

Q. Okay. And why is this something that you wanted to investigate?

A. Because this would be like a version of bias. Like if it had skewed toward one party versus the other. I mean, if all the seats are competitive and they all are competitive toward the Republicans, then that's not -- that's not really fair on a different dimension even though there's fairness, perhaps, on competitiveness. You know, likewise if all the seats are competitive but they're all -- you know, the Democrats have more in all of those competitive seats, then that's also likewise biased.

Q. Okay. And let's look at page 37 of your initial report and

Figure 23. Can you explain what you've depicted here.
A. Yes. So this is the competitive measure with the numbers that are created from this equation on page 36, so that's how I computed that number.
And the closer you are to zero or to the left means that the map would be considered more competitive. So the histogram is showing the values of that competitiveness measure, and then the red bar shows where the current map is.
Q. Okay. So now, earlier you mentioned in one of your earlier answers this formula that appears on page 36 of your initial report. Can you provide a little bit more detail about what this formula represents?
A. So I said that it captures both the number of seats that are won for each party as well as how competitive they are. So it takes both competitiveness and which way those seats lean and it puts it into one measure.
Q. Do you consider the formula that's represented here to be a type of metric?
A. Yes, it would be a metric.
Q. Okay. Now, how did you go about using this metric or this formula in the context of the simulations analysis that you did in this case?
A. So I didn't use it when I created the maps. I only used it after the maps were created. And then after the maps were created, I wanted to see, you know, what's the partisan

characteristic of these maps that I simulated with this non-partisan, no political data process.

Q. Okay. And then just to revisit Figure 23, can you just explain your last answer in terms of how you used this formula or this metric in analyzing the simulated maps that were generated through your process.

A. So after the maps were created, then I took each map and I said, Okay, what is your score on this competitiveness measure? And I would do that for each of my maps, and then this is the summary of that. And then I did it for the current map.

Q. Okay. Now, have you ever presented this formula that appears on page 36 of your initial report, have you ever presented that in any publications?

A. Yeah. It's in two of my publications.

Q. Okay. And which publications are those?

A. I have to look up the title.

Q. Sure. And are you checking the CV, P086?

A. Yeah.

Q. Okay.

A. So it shows up in this paper "Toward a Talismatic Redistricting Tool," which was published in The *Election Law Journal*, and it also showed up in this publication that's two down from there, "PEAR: A Massively Parallel Evolutionary Computation Approach for Political Redistricting Optimization and Analysis."

Q. Okay. So in the article that stars with "PEAR," can you describe how you used this formula?
A. So PEAR is a different algorithm that we developed, and that algorithm is what we call an optimizer. And in an optimization algorithm you feed it in what you want to optimize. So, for instance, if you want to optimize competitiveness, you know, if you want to create maps that, you know, have really good competitiveness, that would be called optimizing competitiveness.
So we thought we'd try to do that, and so we created this measure that's in this equation, and that's what we used in that paper to, you know, show people that you can use the PEAR algorithm, which is not the algorithm that I used here, but you can use the PEAR algorithm to create maps that are more competitive or that try to optimize on competitiveness.
Q. So in that article was the formula being for the purpose of creating optimized maps?
A. Yes.
Q. Okay. And did you use the formula to create optimized maps in this case?
A. No.
Q. Did you use the formula in any way in the creation of the maps in this case?
A. I did not.
Q. Okay.

Okay. So did you do any other analysis of the partisan effect of the current map versus the simulated maps using other metrics?

A. I did. There were two others, and these were based on the seats-votes curve, which is also something that is in the political science literature and is discussed fairly often.

Q. Okay. And, I'm sorry, is there a portion of your initial report where you discuss your analysis on these other metrics?

A. Yeah. So there's two. One is called the "Responsiveness" and one is called "Bias," and those are shown in Figures 25 and 26.

Q. Okay. And did you reach any conclusions based on the analysis that's captured in those figures and that portion of your initial report?

A. For those two or for --

Q. For the two figures that you just mention in the last portion of your report from pages 37 through the end, from the analysis that's described there, did you reach any conclusions?

A. Yes. So the same idea there. My maps that were created from this non-partisan process are more fair on these two metrics than the current maps. So you can see where the current map is, and it lies outside the range of where my maps fell.

And so for the responsiveness one, being on the left is bad, because as you go right, the map is more responsive to the

voters. And so there being on the left is bad. I actually had some simulated maps that were worse than the current map, but it wasn't very many of them, almost none of them.

And then in the biasedness map being on the right is -- actually, being outside zero is bad for that one, either on the right or on the left. So being on one side means you're biased toward one party. Being on the left means you're biased toward the other party. In this case the bias is greater toward the Republicans.

Q. Okay. And when you said the bias is greater towards the Republicans, is that reflected on the right side?

A. Yes, on the right side.

Q. Okay. Now stepping back and looking across all of the different analyses you did on all of the different partisan metrics, were you able to reach any overall conclusions based on that analysis of partisan metrics?

A. Yeah. So I looked at, you know, a number of different metrics. And as I said, the simulated maps help me understand what's typical, what is a typical outcome from a non-partisan process of drawing a map with, you know, people in the state of Ohio. And in every instance of the metrics that I looked at, the current map is not typical. It's quite unusual. Its partisan effect is quite unusual.

Q. Okay. Now, earlier we discussed natural political geography. After conducting your analyses of these different

partisan metrics, were you able to reach any conclusions about whether the 12-4 result under the current map is attributable to natural political geography?

A. So I think I mentioned earlier when we were discussing my map creation process, my map creation process uses the state of Ohio, it uses data from the state of Ohio. These are Ohio's voters that are being drawn into districts. I don't move them around. This is where they were.

And so my maps are constrained by political geography, just as the current map is constrained by political geography. So in that way, the effect of political geography, if it exists for the current map, it also exists for my map. So if it made the current map be a little bit more Republican or a little bit more Democrat, it did that also to all of my simulated maps.

Q. Okay. So based on that answer, are you able to draw any conclusions about whether the 12-4 result in the enacted map is attributable to political geography?

A. It is not attributable. The unusualness from my maps is not attributable to political geography.

Q. Okay. Now, earlier you also mentioned other factors that a legislature might take into account in the process of enacting a map, and I think you gave an example of moving the district line so that a particular cemetery is in the district of a given legislator and other such examples.

Is it possible that those types of legislative negotiations

or bargaining is what led to the 12-4 results?

A. So this is how to understand my analysis here. I guess I'll repeat it again. But the histogram shows what you would expect from a non-partisan process. Right? And this non-partisan process involves the legal constraints and the traditional districting principles that I mentioned.

I know that there are other decisions that go into these maps, I would say a lot of other decisions, that there's a lot of bargaining going back and forth, people want this, people want that, and I'm not -- I don't know what I would say pretty much all of those decisions were. I don't know how that process proceeded. What I'm telling you is, the histogram shows you, if there wasn't any partisanship going on, you know, there wasn't partisan decisions or decisions being made on partisan grounds, this is the natural result.

So every time you make a decision that's outside of the range that I considered, you know, the law or traditional districting principles, it will have a political partisan effect not necessarily because, let's say, splitting a military base in a certain way, not necessarily because that's a partisan-motivated decision. I'm not saying anything like that. What I'm saying is there are a lot of these decisions, and if they're not partisan, then, you know, sometimes it will make the map a little bit more Republican because you move the line. Sometimes it will make it a little bit more Democratic.

If they're purely non-partisan, you can kind of think of it as, you know, flipping a coin maybe. So sometimes -- because it's not partisan, sometimes that non-partisan move of the lines will be more Republican. Sometimes it will be more Democratic. Right? It's not systematic because it's a non-partisan decision or a non-partisan, you know, element that's going into the map.

So we have the histogram which shows this is the natural non-partisan result, and then there's these other decisions that resulted in the final map.

And the final map falls off to the right, and so these other decisions, whatever they may be -- and I'm not saying they're partisan or they're not partisan -- but they moved it so that the outcome is to the right of the natural non-partisan outcome. And the way I understand this or I would say you should interpret this is, let's say you have --

I'm going to go back to the coins. Right?

You toss the coin a thousand times and you have this distribution. And you know, a fair coin, this is what the outcome looks like. Most of the time it's kind of in the middle. Right? And if it appears a little bit to the right, that's, you know, at like maybe 600 out of a thousand heads. You could say, well, that's not, you know, as common as 500, but I wouldn't say it's unusual. It still happens pretty often.

If you get a thousand heads out of a thousand tosses and it's all the way on the right --

That's not to say that can't happen with a fair coin, that actually can happen with a fair coin. And it actually does happen with a fair coin. If you do it enough times, that will eventually happen.

-- but if that happens, I think -- you know, you just think about it just on an intuitive level. If you saw somebody and they said, "Hey, this is a fair coin," and they just kept tossing it for you and you're watching it and it comes up heads every time and then it comes up heads all 1,000 times, I don't know about you, but I kind of think, "Let me see that coin. Let me flip that coin." All right?

To me it says: I think that coin isn't fair. Whether it is fair or not, I don't actually know. If it comes up heads a thousand times, it is not definitively an unfair coin because it can happen with a fair coin, but it's such an unusual event that it makes you think it's not a fair coin.

So in the same way with this. I give you the distribution for a non-partisan process. So if you would come up with nine seats, then I would have said, "Well, that's kind of a typical outcome. I don't think that's weird at all." If you say, "Was that from a non-partisan process?" I'm like "I -- I would believe it."

And then you say there's all these other choices that go

into it. So it's like the coin. Some of them will move, you know, to the right a little; some of them will move to the left a little. And this is like, okay, there's all these other decisions. And it systematically kept moving in one direction, kind of like the coin, you know, every time you hit it, it came up heads. So every non-partisan decision became a little bit more Republican for the map, became a little bit more Republican, and then moved it all the way to the right.

So I'm not saying that these other decisions -- I don't even know what they are -- are partisan or are not partisan since I don't even know what those decisions were. I'm just saying there are all these other decisions that went into it, and that kept moving that marker to the right.

And so in that way you can look at it and say, "Well, I'm a little bit suspicious. If you have all these non-partisan factors going in, how come you kept moving it all the way, you know, in one direction and moved all the way to the end of that distribution?"

So I don't know what the decisions were, I don't know that they were partisan, I wasn't part of any of these things, but this is, you know, to me evidence that they weren't all non-partisan, that some of them probably were. I'm not saying they were, I'm just saying that the evidence weighs heavily in that direction.

Q. Okay. So let's turn to page 16 of your rebuttal report.

Your rebuttal report is P08. I'm sorry, P088. And on page 16 of that report you discuss a statistical test proposed by the defendants' expert Dr. Thornton. Do you see that section?

A. I do.

Q. Okay. Now, is this statistical test one that you have seen used in political science literature for determining whether a map is a result of partisan gerrymandering?

A. I have not.

Q. So let's look at this table that you have on page 17. It's Table 3.

So first of all, did you create this table?

A. I did not. It's from Dr. Thornton's report.

Q. Okay. And do you have an understanding of what the column with the title "Republican Vote Proportion" represents?

A. Yes. So that's the statewide vote, Republican statewide proportion of the vote in 2012. And then, you know, 2014, 2016.

Q. Okay. Do you have an understanding of what the Number of Seats column represents?

A. Yeah. That's the total number of seats, congressional seats in Ohio.

Q. And how about the column labeled the Number of Republican Seats?

A. That's the number of seats that was won by a Republican candidate.

Q. Okay. So in the next column over there's a heading that says "Expected Republican Seats." Do you see that heading?
A. I do.
Q. Okay. Do you have an understanding of how Dr. Thornton calculated the numbers in that column?
A. Yeah. She took the -- so I'll just refer to that first row.
She took 51 percent of 12. So she took the first -- I guess that's the second column, and the fourth column. So 51 percent of 12 is 8.16.
Q. Okay. And do you have a view of whether the expected Republican seats figure as you just described, is that a valid baseline for evaluating the challenged map?
A. It is not.
Q. And why is that?
A. Because that's proportional representation, and we don't have a system of proportional representation in the state of Ohio for congressional seats. So just because the Republicans get 51 percent of the statewide vote doesn't mean they're going to get 51 percent of the congressional seats.
JUDGE NELSON MOORE: If I could ask a question. I'm a little confused. On the 2012, 51 percent of 12 is not 8.16. Isn't it 51 percent of 16?
THE WITNESS: Oh, I'm sorry. You're right. I misspoke.

Q. Okay. So just to clarify that point, the expected Republican seats column, to your understanding Dr. Thornton calculated that by applying the Republican statewide proportion times the number of total seats; is that right?
A. Yes, that's correct. That was my mistake.
Q. Okay. Now, the next column over has a heading that says "Difference Between Actual and Expected." Do you see that column?
A. I do.
Q. Do you have any understanding of how Dr. Thornton came up with the numbers that are in that column?
A. Okay. Now I think I get to use my 12 number.
It's the number of Republican seats, the difference between the number of Republican seats that actually occurred and then this expected number of Republican seats. So it's 12 minus 8.16.
Q. Okay. And then in the final column there's a heading that says "Number of Standard Deviations Associated with the Difference."
First of all, do you have an understanding of what that heading means, what it describes from a statistical point of view?
A. I do.
Q. And could you explain that.
A. So the concept of a standard deviation is what do we --

what is a big difference and what is a small difference?

I'm not describing that well. The way to understand it is, usually if something is within two standard deviations, it means that 95 percent of the data that you would see would fall within two standard deviations. So about 68 percent would fall within one standard deviation. So it's this kind of idea, again, of typical.

So if 68 percent of the things happen within one standard deviation, we think of that as kind of typical, in that typical range. And so when you get out to two standard deviations from the mean or the expected number, we think of those as a little less typical, but it still encompasses 95 percent of all the outcomes. And then when you get out to three standard deviations, you're out to 99, more than 99 percent.

Q. So let me ask this question. Do you have an understanding of what Dr. Thornton was purporting to demonstrate through this final column and the numbers that appear in the final column?

A. Yes. So she is -- she presented this as a test to say "Is getting 12 Republican seats, would that be an" -- it's kind of the same idea -- "Is that unusual given that we would expect eight seats?"

Q. Okay. And do you know what formula Dr. Thornton used to come up with the numbers that appear in that final column?

A. Yeah. So the standard deviations are calculated in different ways, and to calculate this one she assumed that the

data could be described by a binomial distribution, and then she used the formula that's associated with a binomial distribution to compute this number 1.92.

Q. Okay. And is this data that's being reflected here, is it appropriate to use a binomial distribution?

A. No, because the binomial distribution makes a number of assumptions before, you know, it could be -- you know, it makes a number of assumptions on the data.

So, for instance, one of them is that what we're expecting is proportional representation. I don't know why we would be expecting proportional representation given that we don't have a system of proportional representation. So that's the first problem, is you've built in an assumption of proportional representation and you're basically testing: Is this outcome very different than proportional representation?

So that doesn't make any sense, because we don't have proportional representation, so I don't know why we would assume it.

And another assumption here is that this 51 percent that's the statewide Republican vote, she assumes that every district in Ohio, all 16 districts, have a 51 percent probability of electing a Republican, and that's just not true. First of all, we have 16 seats. The seats are very different, some of them are, you know, very Democratic, some of them are very Republican, but we would not expect all 16 seats to have the

same probability of electing a Republican. And I think it's pretty clear that all 16 seats in Ohio don't have the exact same 51 percent probability of electing a Republican.

That's the statewide average. You know, for instance, we have, as I said, political geography. Right? And in areas where there are more Democrats, in districts where there are Democrats, I don't know why we would expect the Republicans to have a 51 percent chance of success. It just -- it doesn't make any sense.

So saying that I'm going to use a binomial distribution and then computing these numbers as she did, it doesn't comport with, I think, anything we know about Ohio. And I think, you know, it -- a lot of times when I teach statistics, I say, you know -- or maybe just life -- there's this kind of, like, sniff test. If something seems weird, you probably did something wrong.

And here, you know, she says if you're within three standard deviations, these are basically all not unusual. And so from her test, she'd say if the Republicans got between three seats and 14 seats, these are not unusual. I mean, that's a huge range for not unusual. Three Republican seats actually is not even possible. You have to draw more Republican seats than three seats given how many Republicans there are and where they live in Ohio. Three isn't even possible.

So to say three Republican seats is just the same as 12 Republican seats, that that wouldn't -- it just doesn't make any sense. It doesn't make sense from how she set this up. It doesn't make sense from just -- you just listen to it you. You know nothing about statistics and someone told you "Three seats for Republicans, 12 seats, what's the difference?" It's like, "I think there's a difference." There is a difference. But her test would say there's no difference.

Q. So the binomial distribution, is that a statistics concept that is limited to use in redistricting?

A. No, I think it's never used in redistricting. It's used in lots of other places, though.

Q. Okay. So if the binomial distribution were to be assumed and applied in a districting context like this, is there an assumption that one would need to make with regard to the probability of a Republican victory in each of the districts?

A. Yeah. So you have to make that assumption. And here she decided that the assumption was going to be it's 51 percent in every district.

Q. So just to back up, so if the binomial distribution is applied in this type of setting, in a districting setting where you have 16 districts --

First, let me ask this. Is there an assumption that one needs to make about the likelihood of Republican victory in each of those districts?

A. Yeah, it's both the same. It's independent of the other districts. So if one district is 51 percent, the next one is 51 percent, they're independent. They have nothing to do with each other.

Q. Okay. So is it the case that the Republican likelihood of victory in each of the 16 districts needs to be identical in order for the binomial distribution to be applied?

A. Yes.

Q. Okay.

A. That's a condition of the binomial distribution.

Q. Okay. Now, on page -- I'm sorry. Strike that.

Now, did you review Dr. Thornton's deposition testimony in this case?

A. I did.

Q. Okay. And do you recall Dr. Thornton providing deposition testimony about something called the Poisson binomial?

A. Yes.

Q. And what is the Poisson binomial?

A. So it's like the binomial, except you get to change this assumption that the probability of success or the probability in this case of electing a Republican is the same in every district. So you can actually say it's a different number in every district.

Q. Okay. And do you recall any testimony from Dr. Thornton in her deposition about whether she had run any analysis using the

Poisson binomial, of this same issue?
A. Yes. So she said she saw me criticize this test in my rebuttal report, and she says: "Okay. That's fine. I can change it. We'll use the Poisson binomial and I'll make the probability of a Republican victory in each district different."
Q. Okay. And if she -- first of all, did you see any such analysis presented by Dr. Thornton?
A. I did not. She just discussed that she could do that.
Q. Okay. So if she were to perform that type of analysis, would that yield a more accurate standard deviation analysis in this context?
A. Not necessarily, and certainly not the way that she proposed to do it.
Q. And why is that?
A. She proposed that she would change it and it would be different in each district and each district could just -- the probability of success for the Republican would be the proportion of the vote that the Republicans got in that district. So every district got a different proportion of the Republican vote in the congressional district, and she suggests that, "Okay, I'll use that," and that's different for each of the districts.
Q. Okay. And if she did that analysis as you just described it, would it yield some valid conclusions about the issue that

she's trying to address here about how unusual a 12-seat result is compared to some other result?

A. So there when she suggested, "Okay. I'm going to use a Poisson binomial, and I'll just -- I'll make it different, I'll use the proportion that the Republicans received," you know, "in that district," that is -- that is basically taking the map, the 12-4 map, and saying, "Okay. I'm going to take that as my base assumption, that this map is okay, because -- and it produces these Republican victory percentages."

And then it says basically that: "Okay. Now that I've assumed that the current map is fine or is the baseline, is the expected result, is getting 12-4 unusual?"

But that's kind of the whole basis of the case here. You can't use the current map and say that thing is the baseline. That thing is not the baseline, because then you're saying, "Okay. Here's my baseline. It's the current map." Is the current map different from the current map? I would say no without even running the test.

Q. Okay. Now let's shift gears a little bit. I want to ask you whether you performed any analysis in this case using your simulations maps, simulated maps, with respect to the 17 individual plaintiffs in the case.

A. I did.

So I took each of my maps and I took each of the plaintiffs, and then I -- so, for instance, I took map number

one and then I looked at, like, plaintiff number one, who was Linda Goldenhar. And I had her address, so I said, "Okay. In map number one, where does Plaintiff Goldenhar live?" And then I found which district she lived in in my map number one.

And then I looked in her district and I looked to see what is the average Democratic vote share in -- what is the Democratic vote share in that district for Plaintiff Goldenhar in map number one?

And I did that for each of my maps. So map number two, again I took her address, I found her district in my map number two, and I looked at the Democratic vote share. I did that for all 3 million maps and then I summarized that, and that was in -- on page 13 of my opening report.

Q. Okay. So turning to that initial report, P087, and specifically page 13, you have here a histogram. It's in Figure 1. And could you please explain what's depicted here.

A. So this is a histogram. It's like all the other histograms we've been looking at. I think it's not quite as pretty, but it's a histogram. The same thing. You interpret it the same way.

So on the bottom shows the Democratic vote share. On the left it shows you how often each one occurred. So it looks like for Plaintiff Goldenhar the highest bar is around .5, so what that says to me is that -- and I think it is at about, about a millionish. So about a millionish of the maps would

place her in a district where the Democratic vote share was about .5.

And then the same for all the other ones. So you can see, you know, at .4, some of my simulated maps had her at .4 but it wasn't -- it was far less common, and then less common as you get below .4. So we're just looking at the heights of the bars.

Q. Okay. So the X axis or the axis along the bottom edge of the figure has labels from 0.0 to 0.2, and so on. Are those percentages?

A. No. They're proportions.

Q. Proportions, okay. And so how would one convert that to a percentage?

A. So .5 is 50 percent, .51 would be 51 percent.

Q. Okay.

A. .4 is 40 percent.

Q. Okay. And then the Y axis, the vertical axis, has two labels, but that's the number of votes?

A. That's the number of the simulated maps that fall in each region.

Q. Okay. And now you have this dark line here and you have an indication on the upper left that says "HB 369." Can you just explain what that line represents and where it came from.

A. So the red line --

I don't know if you're looking at a red one, because mine

isn't in color. But it used to be red if it's in color.

The red line shows the average two-party Democratic vote share in Linda Goldenhar's actual district since the map has been enacted. So there have been three congressional elections: 2012, 2014, 2016. And if you look at my table, which is on the previous page, 12, I show you that you have three elections, and then I take the average of the three elections.

So for Plaintiff Goldenhar that's 39 percent. So on average, the Democratic candidate received 39 percent of the two-party vote. So that's where I put that line; that line is at 39 percent. And then the histogram shows you, you know, what, from my -- if I looked at my simulated maps, this is the percentage of the Democratic votes in her district in the simulated maps, and I'm comparing that to what actually happened for Plaintiff Goldenhar.

Q. Okay. Now, in this Figure 1 you also have an arrow toward the middle of the image pointing to the right, and you have some text above that. Can you explain what you're indicating through that arrow and text.

A. So I'm showing that -- I draw the arrow to the right, and the arrow starts at the red line, and then it says that 95.68 percent of the simulated maps resulted in a district for Plaintiff Goldenhar that has a higher Democratic vote share than what actually occurred in the congressional elections in

her district.

Q. Okay. Now, did you perform this same analysis for each of the other plaintiffs?

A. I did.

Q. And where in your report can that analysis be found?

A. So it's in the subsequent pages, 14 to 17.

Oh, I'm sorry. I said "pages." 14 to 29, Figures 1 through 17.

MR. SUBHEDAR: Okay. Thank you.

So let's bring back up Figure 1 for Plaintiff Goldenhar, and let's do a -- if we can put that on the left side of the screen. And on the right side of the screen I'd like to bring up Plaintiffs' Demonstrative PD106.

Q. Dr. Cho, do you recognize this demonstrative on the right side: PD106?

A. I do.

Q. Okay. And can you explain what is shown here?

A. So here I'm just trying to put all the plaintiffs on one plot so you can see them all together. The plaintiff name is on the left. Democratic vote share is on the bottom.

So Plaintiff Goldenhar, the histogram had values from -- I have to eyeball this -- about 32 percent to about 52 percent. That's what's shown in the histogram. So her values go from the left of the histogram, at about 32, all the way to the right, which is about 52. So the blue line is showing you that

range. It goes from about -- well, it goes in that same range.

So that shows you that, you know, the left of the histogram to the right of the histogram. So that's the range. And then the X shows the mean value in the maps, and then the O shows the median.

Q. Okay. So just to make sure we're clear, the histogram you're referring to is on the left side of the screen, and that's Figure 1 from your initial report; correct?

A. Yes.

Q. All right. And then the blue line that you mention is in the demonstrative; is that right?

A. Yes.

Q. Okay. So I think you mentioned something about the range. Well, strike that.

Is the data that's presented in these two images on the screen, that is, Figure 1 from your initial report and the demonstrative, is the data the same for Goldenhar?

A. Yes.

MR. SUBHEDAR: And let's bring up PD107, please, on the right side of the screen.

Q. Do you recognize this demonstrative?

A. Yes.

Q. And what does this demonstrative show?

A. So this one is exactly like the one it replaced, except this one has a green dot. And so the green dot is --

corresponds to the red line.
Q. Okay.
A. So the green dot here is at 39 percent, and the red line was at 39 percent.
Q. Okay. So again just to clarify, the green dot you're referring to is the green dot shown in PD107; is that right?
A. Yes.
Q. And the red line is the bolded line that's in Figure 1 of your initial report; is that right?
A. That's correct.
Q. Okay. Let's turn now to the next demonstrative, Plaintiffs' Demonstrative 108, PD108.
MR. SUBHEDAR: And I think we can take the left side down for now.
Q. Okay. Do you recognize this demonstrative?
A. I do.
Q. And what is depicted here?
A. So the blue line and the blue X and the blue O were exactly the same as the previous ones, at times we've seen that, except now, instead of the green dot, we have an orange dot. And the orange dot is evaluating the current map with the '08-'10 statewide data.
Q. Okay. And what are the blue lines indicating on this?
A. This is still that -- the range of the histogram.
Q. Okay.

A. It's the same.
Q. Okay. Let's go to the next demonstrative, please, PD109. Do you recognize this demonstrative?
A. I do.
Q. And what is this depicting?
A. So this, we've got the same idea going here. The blue line is the range of histogram. The X and the O are the mean and the median. The difference between this blue line and the other ones is that this one is based on the recent -- the most recent election in 2018.
Q. Now, why did you rerun the analysis using the 2018 election data?
A. The same reason as before. I'm just trying to, you know, hit the data in a different way, look at it over time, look at it with different elections, look at -- you know, just different ways of looking at the same thing.
Q. Okay. Let's pull up Plaintiffs' Demonstrative 110, PD110. Do you recognize this demonstrative?
A. Yes.
Q. And what is this depicting?
A. So this is using the 2018 data, and then this dot, which is orchid, or purple --
I don't know what it looks like to you, but the official color is orchid.
-- shows the result from the actual elections that were run

for Plaintiff Goldenhar using the 2012 to 2018 actual elections. So before we had the 2012 to 2016 data, and then later we got an update with the 2018 congressional elections. It just kind of updates with the 2018.

Q. Okay. So then, finally, let me show you the Plaintiffs' Demonstrative PD111. Do you recognize this demonstrative?

A. I do.

Q. And what does this depict?

A. So the blue line is just the same as the last one, and here I've got a new dot. This dot is blue, or cyan, and this dot is evaluating the current map with just the 2018 data.

Q. Okay. Now let's turn to page seven of your supplemental report, which is P426. And there is a plot here on the bottom portion of the page. It's Figure 4.

Can you just explain what is illustrated here in Figure 4.

A. So here I put all the dots. There's the green one, the orchid one, the orange one, the blue one. So all the dots. And all those dots are at the same places in those demonstratives that I just showed you.

So I guess this one is a little bit more confusing when you see all the dots on one. But this is the same idea as, you know, before when I was saying I'm showing you data from '08-'10, now I'm showing you what happened in '12-'14, now I'm showing you what happens in 2018.

So the idea here is, you know, the results change a little

bit because every time there's an election run or you get -- you know, there's new data, then things change a little bit. And so it's the same thing like before. I'm trying to give you lots of cuts of the data so you can see it in different ways and, you know, kind of get a better, bigger picture of what's going on, more complete.

MR. SUBHEDAR: Okay.

So, Your Honors, at this time I would like to move into evidence some of the output data from Dr. Cho's simulations. We'd like to have it in the record just on the off chance there's some issue later.

PX 448, I believe there's no objection, at least that was recorded by defendants and intervenors. And then the other three are PX 449, PX 452 and PX 453. And again, all of them are basically forms of output data from simulations.

JUDGE BLACK: Any objection to their admission?

MR. McKNIGHT: No, Your Honor.

JUDGE BLACK: They're admitted.

MR. TUCKER: No, Your Honor.

(Plaintiffs' Exhibits 448, 449, 452 and 453 were admitted.)

MR. SUBHEDAR: Okay. I have no further questions at this time, Your Honors.

JUDGE BLACK: Very well.

Do defendants and intervenors wish to begin their cross?

MR. TUCKER: Your Honor, I was just going to ask the

Court the same question. I know we're about 20 minutes to 5:00. I wish I could say that I would only have 20 minutes of cross, but it's going to be significantly longer than that. So we're happy starting afresh at 9:00 AM tomorrow morning, if that's preferable for the Court.

JUDGE BLACK: You will never find this Judge disagreeing with breaking early.

(Laughter.)

MR. TUCKER: I thought that might be the case, Your Honor.

JUDGE BLACK: In large part. It will also eat up some of tomorrow.

So we're going to break today. We'll come back tomorrow. Plaintiff will continue its case, and the defendants/intervenors to be ready to go at 2:00 o'clock with a witness.

Any issues for the Court before we adjourn for the day? From the plaintiffs?

MR. FRAM: The only thing to confirm, Your Honor, is that the only witness they're disclosing for tomorrow is Mr. DiRossi. We're not going to get another bunch of witnesses at 7:00 tonight after everything we heard today, I hope.

JUDGE BLACK: Is that the intention?

MR. McKNIGHT: That's right, Your Honor. That's correct.

JUDGE BLACK: Are you comfortable, sir?

MR. FRAM: Thank you, Your Honor.

JUDGE BLACK: Very well.

Anything from the defendants before we adjourn for the day? Anything from the defendants before we adjourn for the day?

MR. McKNIGHT: No. No, Your Honor.

JUDGE BLACK: Intervenors?

MR. TUCKER: Your Honor, just one question. I know during breaks the witnesses have been admonished not to discuss their testimony with anybody. Does the same instruction apply?

JUDGE BLACK: Thank you.

Professor, you're not to discuss your testimony between now and when you come back tomorrow morning at 9:00. Understood?

THE WITNESS: I understand.

JUDGE BLACK: Very well.

MR. TUCKER: Nothing else, Your Honor. Thank you.

JUDGE BLACK: All right. We're prepared to adjourn.

COURTROOM DEPUTY: All rise. This court is adjourned.

(Witness temporarily excused.)

(At 4:40 PM, the trial was recessed, to be continued at 9:00 AM on Friday, March 8, 2019.)

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INDEX OF WITNESSES

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EXHIBITS

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C E R T I F I C A T E

I, Luke T. Lavin, RDR, CRR, the undersigned, certify that the foregoing is a correct transcript from the record of proceedings in the above-entitled matter.

s/Luke T. Lavin
Luke T. Lavin
Official Court Reporter